THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CVIII. No. 2432.] LONDON, DECEMBER 21, 1909. [61ST YEAR. PRICE 6d.

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PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH,

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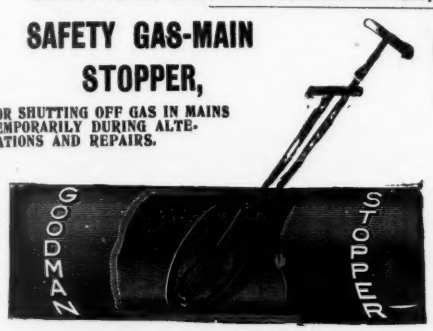

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With all Latest Improvements.

SHORT'S IMPROVED AND ANSELL CLOCK FORM.

For Ground Use, Flush Boxes, &c.
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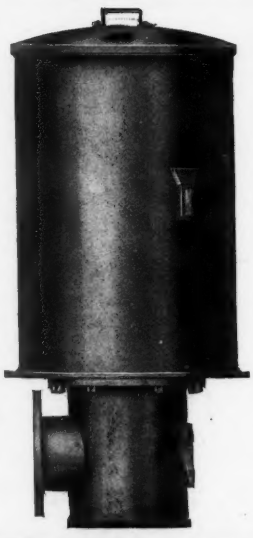

RETORT HOUSE GOVERNORS.

THESE Governors are made to prevent fluctuation in the Pressure of Exhaust in the Hydraulic Main by controlling the Gas entering the Governor, notwithstanding the constant varying quantity of Gas coming from the Retorts. This enables the Seal of the Dip Pipes to be reduced to a minimum with perfect safety, and an increase in the make of Gas per Ton of Coal is thereby assured.

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SPECIAL
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AND
REGENERATOR
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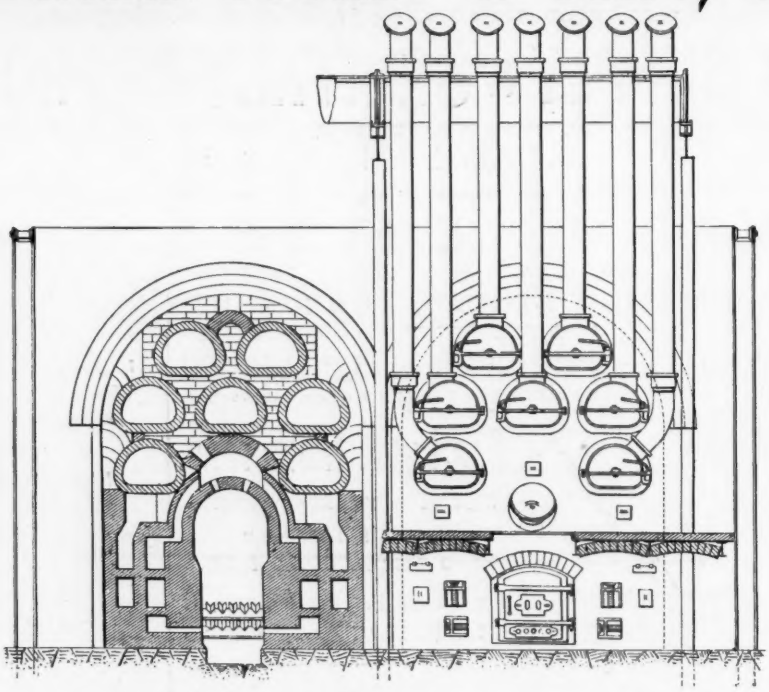

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RESULTS
WITH REGARD
TO HEATS
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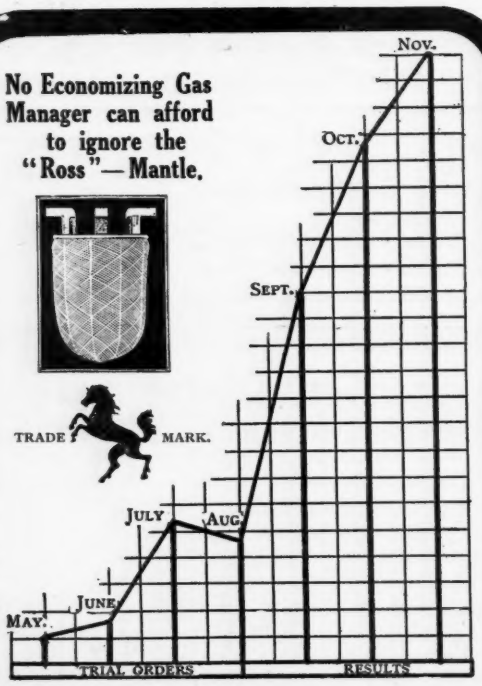
IN FUEL.

ESTIMATES AND FULL PARTICULARS ON APPLICATION.

THE IRON WORKS, FROME, SOMERSET.

No Economizing Gas Manager can afford to ignore the "Ross"—Mantle.

TRADE MARK.



This diagram of monthly Sales shows the success of the "Ross" Patent Mantle since we first brought it to the notice of the British Gas Companies in May last.
The curve speaks for itself.
So does the "Ross" Mantle—Upright or Inverted.

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Our "HULO"
INVERTED BURNER

Heavy Quality.

Brilliant Light.

FURTHER IMPROVEMENTS BUT
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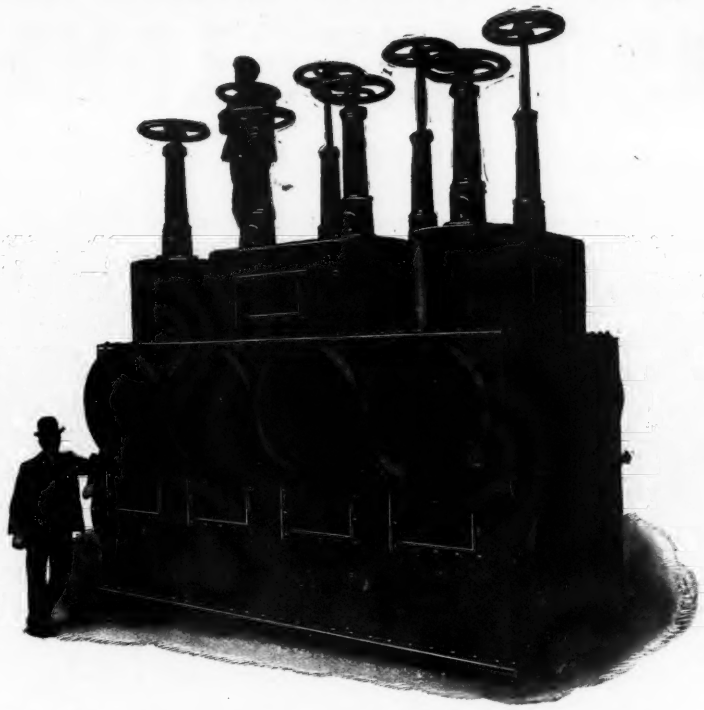

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PATENT COIN PREPAYMENT GAS-METER

FITTED WITH

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ENSURES ABSOLUTE SECURITY AGAINST THEFT.

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The Inverted Burner has met with great success, but it has by no means

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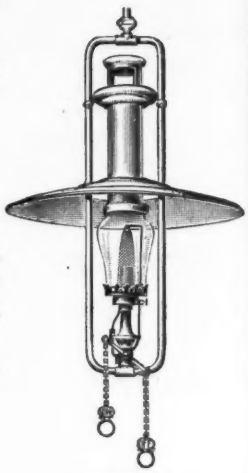

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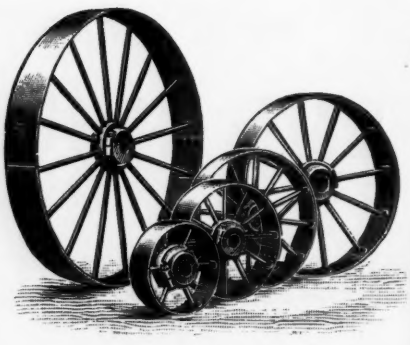

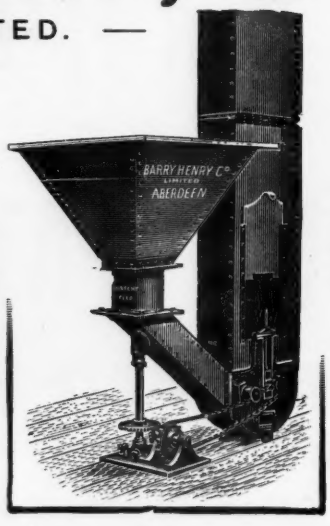

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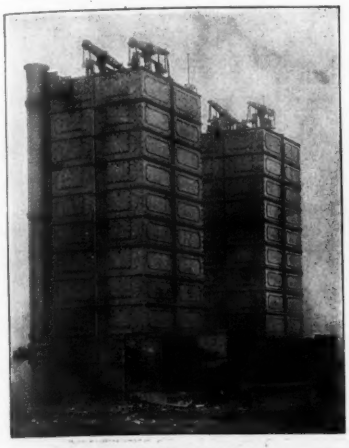

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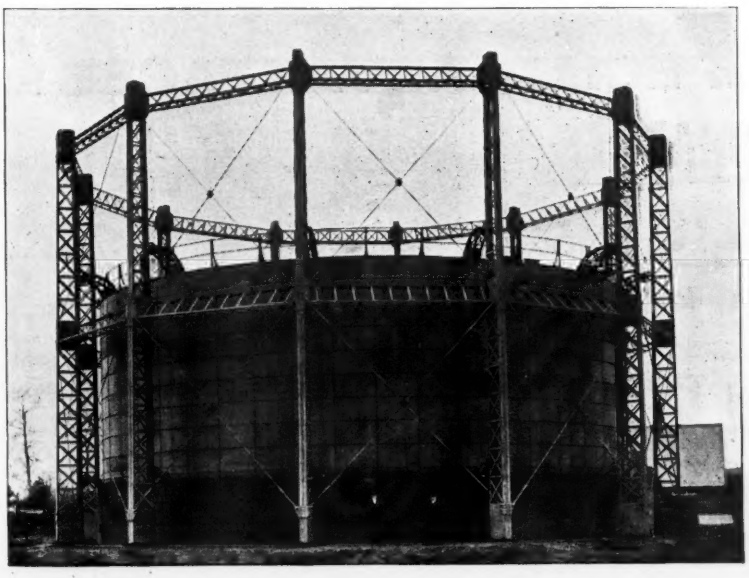

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Gas Retort, Fire-Clay, Red and Blue Brick Works,

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Manufacture best quality only of every description of Inclined, Horizontal, and Segment Retorts, Lumps, Blocks, Water-Gas Blocks, and Checker Bricks.

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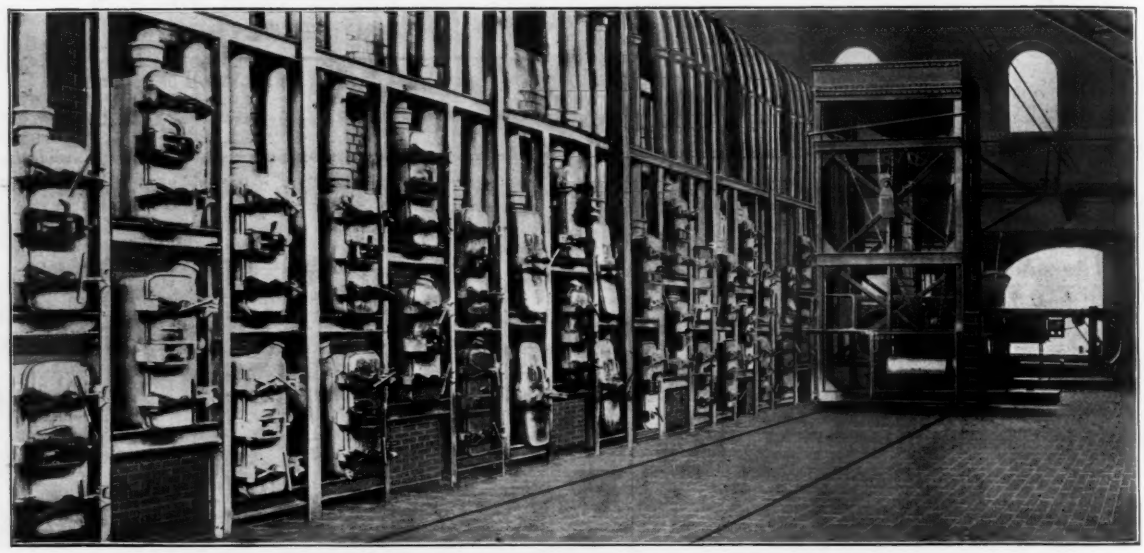

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21 CWT. CHARGES or larger it required.

GAS RESULTS, **13,600** cub. ft. of **14·5** c.p. gas per Ton of coal carbonized.

COKE, **GREY, DENSE,** and **MASSIVE,** suitable for many metallurgical purposes and for malting.

OPERATING COSTS considerably lowered owing to greatly reduced number of operations.

ADAPTABLE TO EXISTING REGENERATORS.

The work of **CHARGING AND DISCHARGING** these Chamber Retorts is performed by the **"D.B." STOKING MACHINES** with the same **SMOOTHNESS** and **RELIABILITY** that characterizes the working of the **"D.B. MACHINES"** with ordinary Retorts.

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"VOELKER" LOOM WOVEN MANTLES.

These Mantles are of great strength and durability, owing to the fact that the Ramie Thread is woven on a loom, and not knitted on a knitting machine as other mantles are; hence there are no series of acute angles in the fabric against which another thread is cutting, this being responsible for most of the breakage to which mantles are subject.

We have the greatest confidence in and strongly recommend this series of mantles; they are very strong, very durable, and give an excellent light. These mantles are specially suitable for Street Lighting and Maintenance Work, and we shall be pleased to send you samples, free of charge, knowing that if you once try them, you will be more than satisfied that we have not exaggerated their good qualities.

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And at 39, VICTORIA STREET, WESTMINSTER, S.W.

CARBURETTED WATER-GAS PLANT.

MAXIMUM EFFICIENCY GUARANTEED.

Inspection of Working Plants Invited.

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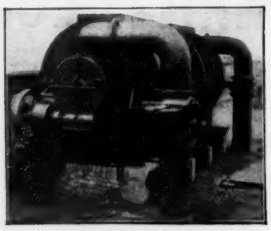

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"HURDLE" GRIDS.

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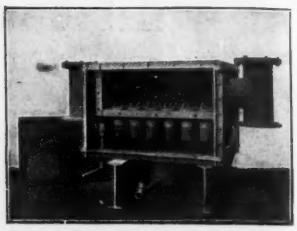

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Wrought-Iron TUBES And Fittings & Accessories.

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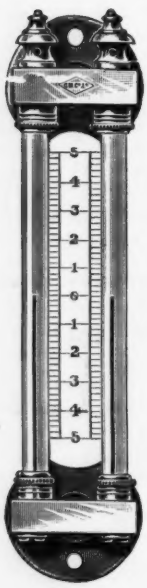

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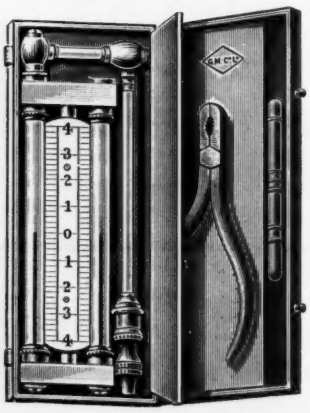

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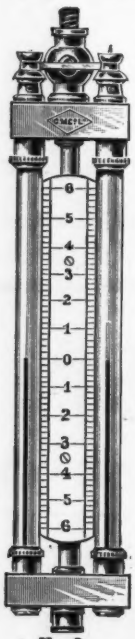

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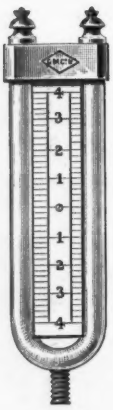

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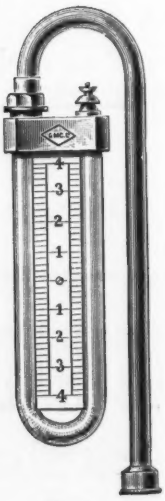

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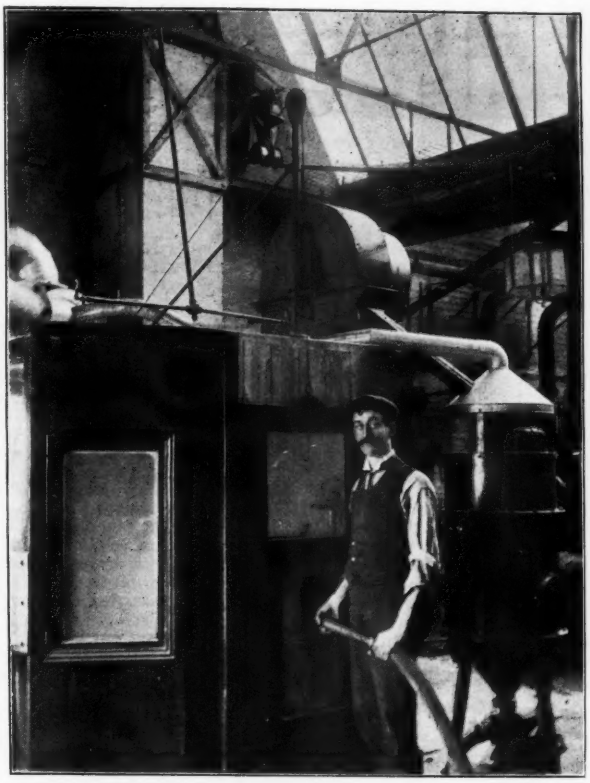
SAND BLAST COOKER CLEANING PLANT.

This Plant will clean all your Cookers, Gas Fires, Radiators, &c., more effectively than by any other method.

SIX CHAMBERS

already installed and

GIVING SATISFACTION.



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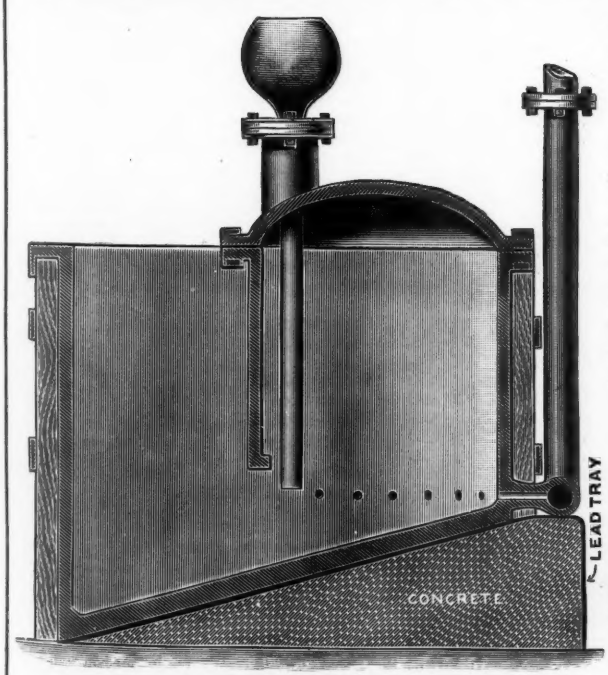

Section showing Williams and Fenner's Patent Outside Cracker Pipe as fitted to our Solid Lead Plate Saturator.

Williams' and Fenner's Patent Saturator with Outside Cracker Pipe, having the following

ADVANTAGES:—

1. **Equal distribution of Steam and Ammonia.**
2. **Perfect agitation and boiling of the Acid Liquor.**
3. **No possibility of local Alkalinity.**
4. **Consequently no formation of Blue Salt.**
5. **Sulphate is easily forced to point of discharge.**
6. **No incrustation.**
7. **No renewals of Cracker Pipe.**
8. **Capacity of output greatly increased.**

IT CAN BE APPLIED TO ANY EXISTING SATURATOR.

LICENCES TO MAKE MAY BE OBTAINED.

For full Particulars apply to the Sole Proprietors

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Agram, Croatia	200,000
Alkmaar, Holland	400,000
Allenstein, Germany	200,000
Antwerp, Belgium	1,500,000
Antwerp (2nd)	1,000,000
Ashford	250,000
Augsburg, Bavaria	425,000
Aylesbury	150,000
Barmen-Rittershausen	500,000
Barrow	300,000
Bath	1,000,000
Belfast	1,700,000
Belfast (2nd)	4,500,000
Benrath, Germany	125,000
Berlin—Charlottenburg	2,500,000
Berlin—Rixdorf	650,000
Berlin—Rixdorf (2nd)	700,000
Berlin—Tegel	3,500,000
Berlin—Tegel (2nd)	6,350,000
Bilston	375,000
Birmingham	1,500,000
Bishop's Stortford	200,000
Bochum, Westphalia	530,000
Bognor	100,000
Bordentown, N.J.	125,000
Bournemouth	1,000,000
Bournemouth (2nd)	500,000
Bremen, Germany	550,000
Bremen (2nd)	950,000
Bremen (3rd)	850,000
Brentford	1,200,000
Brentford (2nd)	850,000
Bridgwater	200,000
Bridlington	150,000
Bridlington (2nd)	200,000
Brieg, Silesia	100,000
Brighton	1,750,000
Brighton (2nd)	1,850,000
Bromley	1,500,000
Bruges, Belgium	200,000
Brussels—Anderlecht	350,000
Brussels—Anderlecht (2nd)	350,000
Brussels—Forest	1,000,000
Brussels—Koekelberg	1,000,000
Brussels—St. Gilles	1,000,000
Brussels—St. Josse	1,000,000
Brussels—St. Josse (2nd)	600,000
Brussels—Ville	750,000
Brussels—Ville (2nd)	750,000
Brussels—Ville (3rd)	1,500,000
Brussels—Ville (4th)	350,000
Bucarest, Roumania	1,100,000
Budapest, Hungary	50,000
Budapest (2nd)	1,750,000
Carlisle	600,000
Carlsruhe, Germany	500,000
Chigwell	350,000
Chorley	300,000
Commercial, London	850,000
Commercial (2nd)	850,000
Commercial (3rd)	1,250,000
Commercial (4th)	2,000,000
Copenhagen	700,000
Copenhagen (2nd)	2,500,000
Courtrai, Belgium	250,000
Coventry	600,000
Coventry (2nd)	600,000
Cracow, Galicia	200,000
Cracow (2nd)	200,000
Crefeld, Germany	500,000
Croydon	1,250,000
Croydon (2nd)	625,000
Croydon (3rd)	625,000
Croydon (4th)	550,000
Debreczin, Hungary	100,000
Deventer, Holland	150,000
Deventer (2nd)	200,000
Dorking	150,000
Dublin	2,000,000
Dublin (2nd)	2,000,000
Dublin (3rd)	650,000
Dundee	1,500,000
Dunedin, N.Z.	150,000
Dunedin, N.Z. (2nd)	275,000
Durham	200,000
Düsseldorf, Germany	1,000,000
Eastbourne	1,250,000
Edinburgh	2,000,000
Epsom	225,000
Epsom (2nd)	300,000
Falmouth	150,000
Faversham	200,000
Flensburg, Sleswig	300,000
Forst, Brandenburg	300,000
Frankenthal, Germany	175,000
G. L. & C. Co. Beckton	2,250,000
G. L. & C. Co., ,, (2nd)	10,750,000
G. L. & C. Co., Bromley	3,750,000
G. L. & C. Co., Fulham	1,750,000
G. L. & C. Co., ,, (2nd)	750,000
G.L. & C.Co., Kensal Green	2,250,000
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Gelsenkirchen, Westphalia	175,000
Gelsenkirchen (2nd)	350,000
Geneva, Switz.	500,000
Gosport	200,000
Göteborg, Sweden	300,000
Göteborg (2nd)	600,000
Graudenz, Prussia	200,000
Guildford	350,000
Guildford (2nd)	200,000
Haarlem, Holland	850,000
Hamburg, Germany	1,750,000
Hampton Court	500,000
Hampton Court (2nd)	600,000
Hartlepool	750,000
Hebden Bridge	200,000
Heidelberg, Germany	200,000
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Hong Kong	450,000
Hull	1,500,000
Ilford	650,000
Innsbruck, Austria	200,000
Ipswich	750,000
Kampen, Holland	350,000
Kiel, Sleswig	1,000,000
Kiel (2nd)	880,000
L. & N.W. Rly., Crewe	700,000
Lausanne, Switz.	250,000
Lawrence, Mass.	400,000
Lea Bridge	350,000
Lea Bridge (2nd)	350,000
Lea Bridge (3rd)	400,000
Lea Bridge (4th)	1,000,000
Leeuwarden, Holland	400,000
Leiden, Holland	500,000
Leiden (2nd)	575,000
Leigh, Lancs.	350,000
Lemberg, Galicia	260,000
Lemberg (2nd)	500,000
Liége, Belgium	1,000,000
Liége (2nd)	750,000
Lincoln	500,000
Liverpool	3,500,000
Liverpool (2nd)	4,500,000
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Louvain, Belgium	800,000
Lübeck, Germany	400,000
Maastricht, Holland	200,000
Magdeburg, Germany	1,400,000
Maidenhead	225,000
Maidenhead (2nd)	225,000
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Malines, Belgium	500,000
Malmö, Sweden	350,000
Malta	400,000
Manchester	3,500,000
Manchester (2nd)	3,500,000
Marlborough	100,000
Mayence, Germany	700,000
McKeesport, Pa.	500,000
Merthyr Tydfil	300,000
Middlesbrough	1,250,000
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Nelson	400,000
Newburgh, N.Y.	600,000
New York	5,200,000
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North Middlesex	150,000
North Middlesex (2nd)	200,000
North Middlesex (3rd)	75,000
Norwich	1,000,000
Norwich (2nd)	300,000
Norwich (3rd)	500,000
Nottingham	1,000,000
Nottingham (2nd)	1,000,000
Nuneaton	125,000
Oberhausen, Germany	175,000
Oldenburg, Germany	200,000
Ostend, Belgium	100,000
Ostend (2nd)	200,000
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Portsmouth	1,000,000
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Posen (2nd)	700,000
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Redhill (2nd)	300,000
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Reichenberg (2nd)	200,000
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Romford	300,000
Romford (2nd)	350,000
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Rotterdam (2nd)	1,500,000
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Rotterdam (4th)	750,000
Rotterdam (5th)	600,000
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St. Gallen (2nd)	225,000
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Shanghai (2nd)	225,000
Shanghai (3rd)	1,600,000
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Stockholm (2nd)	1,750,000
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Stockport (2nd)	600,000
Stockport (3rd)	400,000
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Swansea (2nd)	1,000,000
Swansea (3rd)	450,000
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Sydney—Harbour (2nd)	500,000
Sydney—Mortlake	500,000
Sydney—Mortlake (2nd)	500,000
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Taunton (2nd)	350,000
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The Hague (2nd)	500,000
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Torquay	350,000
Tottenham	750,000
Tottenham (2nd)	750,000
Tottenham (3rd)	350,000
Tottenham (4th)	1,000,000
Tottenham (5th)	1,000,000
Tottenham (6th)	1,250,000
Tunbridge Wells	1,000,000
Utrecht, Holland	1,000,000
Utrecht (2nd)	1,000,000
Verviers, Belgium	1,000,000
Vienna	3,500,000
Vienna (2nd)	2,500,000
Waltham	400,000
Wandsworth & Putney	1,800,000
Watford	300,000
Watford (2nd)	350,000
Wellington, N.Z.	350,000
West Bromwich	550,000
West Ham	1,500,000
West Ham (2nd)	800,000
Weston-super-Mare	350,000
Weston (2nd)	350,000
Wexford, Ireland	100,000
Wiesbaden, Germany	850,000
Winchester	225,000
Winchester (2nd)	125,000
Wolverhampton	1,500,000
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Zwolle (2nd)	200,000

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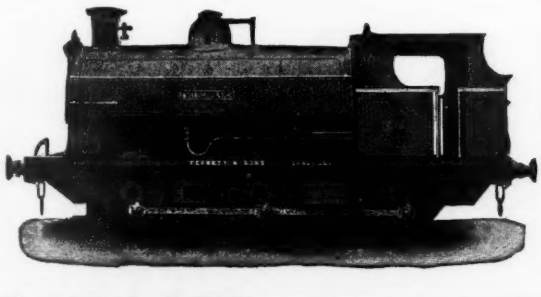

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JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. CVIII., No. 2432.—TUESDAY, DECEMBER 21, 1909.

EDITORIAL NOTES—GAS, &c.

The Hamburg Holocaust.

THE further particulars of the great gasholder disaster at Hamburg which are given in another column of to-day's "JOURNAL," convey two items of information which all our readers will receive with sincere thankfulness. The first is that the loss of life and limb is given by the "Journal für "Gasbeleuchtung" at a lower figure than that quoted by us from the daily press last week. The number of lives lost is now stated to have been eighteen; and the number of persons seriously injured is reduced to about twenty-three. Heavy though the sacrifice of human life still remains, we rejoice to be able to correct the earlier reports which made it much heavier. The second welcome item of news is that Mr. E. Körting of the Imperial Continental Gas Association has been chosen by the Public Prosecutor to assist in the inquiry into the cause of the disaster, apparently in a capacity similar to that of a technical assessor or adviser of the judge in an English court of law. The choice is a happy one, for few gas engineers in the world, and probably no one of his colleagues among German gas men, have had so cosmopolitan a training and experience in gas-works construction and maintenance. His ability and sound judgment should go far towards ensuring the origin of the disaster being clearly revealed by the official inquiry.

While we must await the technical evidence to be given at the inquiry before presuming to form a definite opinion as to the cause of the accident to the large new gasholder, certain facts already stand out in the reports of the occurrence which admit of certain conclusions, and no other, being drawn. It now seems clear that gas first escaped from the gasholder through a rift in the ceiling of the vault or chamber in the interior of the tank. Whether the structural material of this ceiling was mainly concrete and reinforced concrete, or whether steel sheets were also used, we are not certain; but whatever the material, it appears that this ceiling carried a layer of water about 6 inches in depth, to ensure it being tight to gas. It also had to bear the pressure thrown by the gasholder when full of gas, which was equivalent to nearly 11 inches of water. The total pressure on the roof of the vault was therefore equivalent to that of a layer of water about 17 inches deep, or to about 88 lbs. per square foot of surface. The approximate diameter of the circular roof, on which there was this pressure, was 230 to 240 feet. What construction was adopted for supporting the roof is not yet known to us in any detail. But it is now certain that, through fault of design or of execution, the roof gave way and the gas poured through the gap into the vault. It is unnecessary to seek far for a source of light at which the immense volume of escaping gas would be ignited, for the vault appears to have housed a kitchen and a canteen. The consequences of the ignition of the gas have already been told. The one outstanding fact is that this type of construction of a gasholder tank of large dimensions is in virtue of these consequences, if for no other reason, henceforth not merely doomed, but damned.

We do not know definitely on what grounds the authorities of the Hamburg gas undertaking decided to erect their new large gasholder in an elevated annular tank partly in steel and partly in concrete. A railway could have been carried round the tank instead of beneath it; and if the diameter had been thereby reduced by a few feet, the height of the gasholder could have been extended to maintain the desired gas storage capacity. The canteen and kitchen are hardly worth consideration in this connection, especially as it appears that, with what now seems a preternatural sense of fitness, the authorities had devoted most of the vault or interior chamber of the tank to the storage of fire-bricks! Herr Scheuss, the German patentee of the type of tank construction adopted, affords us a clue to the reason which probably chiefly determined its choice in this case, in that he claims in his patent specification that this construction is less costly than others. The cost of the Hamburg gasholder, exclusive of the cost of the foundations, works out at almost exactly £7 per 1000 cubic feet of gas. Large gasholders have certainly been constructed in this country at a lower cost per 1000 cubic feet of storage space; but it may be admitted that the Hamburg cost was not high. The economy, if any, of the special type of tank construction, however, has been, as the events have turned out, very dearly bought at Hamburg.

Standard Burner Bills.

COPIES of the three Bills through which some 47 Gas Companies (including 49 undertakings, counting the three represented by the British Gaslight Company) are proposing to obtain the consent of Parliament to the substitution of the existing standard burners by the "Metropolitan" No. 2 burner have been forwarded to us by the Parliamentary Agents (Messrs. R. W. Cooper and Sons). One change—that of burner only—is all that is sought through the measures. There is no proposal for altering the nominal standard illuminating power of the gas mentioned in the Acts of the Companies concerned. The claims to the substitution of the new standard burner for old ones are modestly stated in the preamble of the Bill; but there is much more that can be put forward by way of emphasizing the points there presented, should it be necessary to produce evidence to meet any opposition that may arise. At present there is not much talk of hostility. There has been some; but this has been apparently started by reading somewhat ancient writings in regard to the questions of illuminating power and testing, without having regard to the more recent parliamentary history connected with the subject. As we have said on previous occasions, Parliament has already shown that it is not now going back on its consistent practice, in this matter of the standard burner, during the past four sessions, nor is Parliament now going to repudiate the advice of the Board of Trade Committee presided over by Lord Rayleigh, and that of the Metropolitan Gas Referees. Nor will Parliament—they refused to do so in the case of Coatbridge last session—impose a dual standard of quality for gas. It must be either one or the other, not both, unless a Company agree. The functions of Parliament do not, or ought not, to include the meting out of injustice; nor is it right of any local authority to expect Parliament to do so. One commodity, one parliamentary standard by which quality is adjudged. That is sufficient; and the principle has ruled through the history of gas lighting since a penal standard test was first imposed. There is subject in these points to which we will return at an early date; but meantime it is hoped that there will be little waste of money, as money has been fruitlessly wasted in previous sessions, by local authorities trying to overthrow a standard instrument that has been accepted by Parliament as proper and fair.

Scientific Illumination Measurements.

IT is an excellent feature (which we are pleased to see is being developed more and more) of the Junior Associations that they court the assistance of men who have recognized standing in some particular line of technical work in the gas industry. The Junior Gas Associations should be above all things educational bodies; and they should seek to get their teachers from the best available quarters—teachers who are themselves both students and practitioners. The lecture and the lecturer that the Southern Junior Association had before them when Mr. Jacques Abady dealt with the subject of "Light—And Some Reflections" (as reported last week) were examples of what should be. And may we say a few words in complimentary vein? Mr. Abady divested himself entirely of any association with any manufacturing concern, and stood before the members of the Association as a

student of his subject—a student not merely moved by the very proper desire of ensuring commercial success, but as one who enters into a subject that has had an almost life-long engagement of thoughts and work for the pure love of the thing. If we were looking for teachers in special branches of work, we should turn to those manufacturing places where there existed good commercial success, and where we knew experience was large and varied. Who can know more of gasholders than those who are every day at work designing, making, or erecting them, and who have had to erect them under diverse conditions? Who can know more of photometers for measuring sources of light and illuminating effect than those who are day by day engaged in making them, and who are day by day working in competition to perfect them, so far as they are amenable to a perfect state?

Therefore, as might have been expected, from the well of experience and practice Mr. Abady gave freely to the Southern Juniors on the perennially absorbing subject of light measurement. "Avoid empiricism" was his text; and truly in connection with the subject of photometry, the monition is required by many of the latter-day arrivals on the illumination platform. There are instances of men who seem to regard complication, and the introduction of purely personal ideals into instruments and practices, as being figurative of science and theory. They deceive themselves; and their counterfeit presentments are anything but acceptable to those who have lived in, and learned of, their subject through many years. In all things, so far as it is possible, whether in testing lighting sources or the resulting illumination, nothing should be left to empiricism; the instruments, methods, and conditions should all be standardized on scientific lines. But photometry will never be an exact science while it can only be conducted by the intervention —and there is no help for this—of any personal factor. The observer's acts and eyesight play an important part in what is, if people will only permit it to be so, otherwise a scientific operation. The plea that Mr. Abady made for the greatest possible accuracy in photometrical operations has the sympathy of the gas industry, and that accuracy is more necessary to-day in view of the great combat that has started between the lights for supremacy in the matter of illuminating efficiency for specific purposes. But the measurement of the relative illuminating efficiency of different light sources can only be properly realized by having precise and reproducible conditions; and these cannot be obtained in any two or more places where surroundings and atmospheric conditions have not uniformity.

The point is well illustrated by the condemnation by Mr. Abady of the "cosine" photometers, and of the methods of certain of the assertive electrical enthusiasts. We know something of those nocturnal illumination observers, the practices they adopt, and the inexact and unreproducible conditions under which they work. The conflicting effects of their work have been recorded in curves in the electrical papers. The observers wander the streets, and no matter whether a street be wide or narrow, no matter whether the reflecting surfaces be good or bad, no matter the conditions of the atmosphere, or of the lights of the firmament —the conditions existing between one set of lamps and another may be as wide asunder as the poles—but they direct their little illumination photometers to the source of illumination, and they say that it gives so many candle-feet, or a candle-foot, so many feet from the lamp. It suffices—for them. In those instruments with movable screens set at will at an angle, the personal factor comes in in this respect, as well as in the condition of the eyesight of the observer. We do not know that anything could be named in the way of measurement that is more subject to variation by surroundings, atmospheric conditions, and personal influences than illumination street tests. Mr. Abady pleads for the repression of all empiricism; and for the defence in these matters of light and illumination testing of complete accuracy. He says he can make a street photometer that is on irreproachable scientific lines, and that eliminates, as much as can possibly be the case, any error in result by the personal element; but there is one thing he cannot do, and that is to standardize the conditions under which the photometer is used. Without standard conditions, what reliance can be placed on the results of the street illumination tests? We are not opposed to street illumination tests from any fear of gaslight, on equal terms, coming out second best in any comparison, but purely in the interests of scientific accuracy and justice as between system and system and lamp and lamp.

Mr. Abady advocates in the illumination photometers employing a fixed screen with a standard surface the reflected light from which should be measured. But that only eliminates a single objection; and in distribution tests, we have no faith in results put forward for comparison that are not made under corresponding conditions, and these can only be obtained in a specially provided testing-place. Tests made under any other conditions are deceptive; and no lamp ought to be condemned on the judgments of inexactness and incomparability. Two lamps measured for distribution or illuminating effect under standard conditions, and this way having an approximate relationship, may, fixed in totally different situations, with surroundings that are dissimilar, or tested separately under a different condition of the atmosphere, give widely varying results in candle-feet. Yet it is upon such tests, hemmed in by all this inexactitude and arbitrariness, that some newly inspired and self-constituted "experts" would prefer that preferential award should be made. We are glad in the interests of scientific work and practice that Mr. Abady has spoken out in connection with the instruments employed in illumination measurement; and though he does not condemn street illumination tests, he asks for accuracy in photometry, he asks for scientific treatment, and he points to the many difficulties and pitfalls that surround street measurements, as well as to the confusion that exists on the subject.

Views and opinions have been stated here upon only one phase of the lecture. It embraces many other matters; but the one dealt with is of no small importance in these days when the rivalry of artificial lights has attained to such keenness. Commercial interests ought not in any way to be injured by any grotesque misrepresentation and misapplication, or non-observance, of any contributory and necessary scientific laws and conditions.

Coalite Hopes and Promises—Continued.

THERE is a liberal mixing of hopes and promises by the Directors of the British Coalite Company, Limited, in their annual report. Broken promises and directorial expressions of confidence are the only things that the shareholders have received in exchange for the hundreds of thousands of pounds of hard cash that have been sunk in this venture; and the outlook to anyone who is in touch with the several commercial spheres in which the Coalite Company must do their business if they are to succeed, is anything but that which the Directors, looking through rose-tinted glasses, present to the shareholders in the report now put before us. The confidence has such an unsubstantial backing that we shall be surprised if the shareholders do not, at their meeting to-day, speak very plainly as to the manner in which they have been unsuspectingly led into the barrenness that lies, in the opinion of most competent judges, before this concern. The Directors now state that they have "the fullest "confidence in the immediate financial success of the "undertaking." Those words will be remembered a year hence. But the immediate point to ascertain is on what ground this confidence is based. On the Board there is the originator of the scheme, Mr. Thomas Parker. Naturally he is hopeful of his child. But what particular qualifications in the technical matters of coal carbonization and tar distillation do the other Directors possess, and what intimate knowledge have they of the markets in which the Company must trade, that enables them to speak with the temerity shown in the quoted sentence? We should like to know. Their confidence is interesting. But it is nothing more than an instructive instance of intellectual credulity; and credulity like theirs is usually found to be of the most stubborn character.

Let us make a brief examination to see if trace can be discovered of the support for the confidence of the Directors. Dating from the time the Company was floated, the central parts of the plant have been undergoing repeated alteration, until now every vestige of its former self has been cleared away. These changes have been going on right up to the present time; but the Directors now believe, as they have believed on former occasions, that they have got an efficient standard type of plant for their purpose. Anyway, the shareholders must be able to assess to-day the value of that grandiloquent talk, through press and on platform, that preceded their investment in this speculative enterprise. The reiterated expressions of confidence followed by plant changes and further postponement of the predicted success, must have largely undermined reliance

in the Directors' confidence. If it has not, then we are bad judges of human nature. However, it is stated that, in the producing plant, new features of great importance to the Company—commercially and scientifically—have been developed, and that "the improvements in manufacture mentioned in our report of last year have shown highly economical results, which will add to the profits of the enterprise." This statement is rather a striking one. The improvements were known a year ago. Then their economical effect should be seen in the present accounts; but we actually find that the expenses that are directly attributable to manufacture and disposal of the products amount to more than twice as much—admittedly on a limited business—as the revenue earned. As a matter of fact, on the half-year's working, there is a balance to the bad of £21,895, notwithstanding that credit is taken for £1045 for coalite and bye-products used in the manufacture of coalite and in foundry, for £1830 stock of coalite and bye-products, and for £12,398 interest on calls in arrear, of which £6452 has been received and £5946 has accrued to date. Let us look at the matter from another standpoint. On the expenditure side of the account, there are the items of coal and coalite and bye-products £16,326; wages and salaries (amounting to almost as much as the raw material) £15,195; and distribution expenses—carriage, cartage, sacks, and packing cases—£2010. These three items alone amount to £31,531; and this sum does not include the fees of Consulting Engineer and Chemist, or Directors' fees, or any other charge attaching to works, plants, offices, and administration. To set against this £31,531, all we can find are the items of £11,576 received for coalite and bye-products, £1045 the value of coalite and bye-products used in manufacture (which is therefore a working expense, and has not produced anything in the nature of revenue), and £1830 representing the stock of coalite and bye-products. These total to £14,451, being the whole of the direct and indirect receipts from manufacture to place against £31,531 for material, wages, and distribution, without taking account of the other substantial—"very substantial" would be better—items of ordinary outlay. There is no honestly conducted gas undertaking in the country that, spending a much less sum on raw material, does not make from its gas and secondary products (and without any tar distillation whatever) a decent dividend for the shareholders.

We have before spoken of the inflated forms of expression used by the Directors in their communications to the shareholders. In this report, it is stated that "very extensive" plant is being erected at Barking, Wednesfield, Plymouth, and Hythe. We should be loth to append our signature to a statement describing the Plymouth and Hythe plants as "very extensive;" and there is doubt as to the applicability of the description to the Wednesfield plant. However that may be, no figures at all are given by the Directors as to the precise returns from the plants at the Plymouth and the Hythe Gas-Works; they merely, with unusual moderation, describe the returns as "steady." But the gas produced is said to be rich in illuminating power, the quality of which exceeds contract requirements. Gas rich in illuminating power has lost its usefulness; as a matter of fact, gas rich in illuminating power is absolutely not the best for incandescent gas-burners, as the evidence, in support of the lowering of illuminating power, of Professor Vivian B. Lewes in connection with Gas Bills in Parliament—the South Metropolitan Gas Bill in 1900, and since—assures all who take an interest in the matter. The shareholders of the Coalite Company will fail to see, in view of this, the point of the Directors' boast as to the gas being rich in illuminating power. As a matter of fact, the gas industry are talking of abandoning illuminating power as the standard of quality and adopting calorific power. Again we are told in the report that further contracts are being negotiated with other Gas Companies, which it is "hoped" will be brought to a—presumably successful—conclusion at an early date. Of course, it is "hoped;" there is a greater amount of this intangible quality than actuality about the whole venture. We have heard of such so-called "negotiations;" and in certain cases it would be better to say that, on behalf of the British Coalite Company (it matters not by whom), invitations have been issued to have installations of the plant on the gas-works concerned.

The fact of the matter is the Coalite Company cannot do without gas undertakings to buy the gas produced, and to supply centres from which to distribute the coalite. On the other hand, gas undertakings, for economic reasons, cannot accept to-day low-temperature carbonization and the revolutionary proposals of the Coalite Company. From the buying of the coal and its carriage to the sale of the coalite and their other products, the margin between expenses and revenue, so far as they have been ascertained, bear a poor representation to the margin derived from gas manufacture on modern lines. As to the gas of 18-candle power, gas undertakings adopting plant on the terms at Plymouth would have to provide means, if not already existing, to dilute the gas made. How the Coalite Company are going to dispose of the gas at Barking is still a problem for solution; for gas companies do not appear at all eager to purchase, and manufacturers requiring gas for power purposes are not evincing any alacrity in erecting factories near the Barking plant, just to oblige the coalite people. As to the other products, their prices will not be ruled by any peculiar virtue, but by the competition they will have to meet. Such special merits, for example, as are attributed to coalite will not appeal to any but smoke abatement enthusiasts (and they are a limited class), so long as coalite is more expensive than coal and gas-works coke. It would therefore be idle to waste time upon commenting on the general statement of the Directors that "the demand for the fuel coalite increases daily." We do not detect the evidences of this; and the advertisements of coal merchants do not testify to the fact that they see any lucrative business in it. From our own point of observation, the whole coalite scheme is out of harmony with the spirit of progress and the requirements of the times in relation to gas supply. The Company have long been wandering through the preliminary stages of development; and the time when they will emerge from it is not within the sight of disinterested observers.

Refractory Materials Inquiry.

The recent correspondence in our columns on the subject of British *v.* German retorts has its interest accentuated by an announcement in another column that the Sub-Committee of the Institution of Gas Engineers on Refractory Materials are setting to work in a practical manner to secure data which may assist in arriving at the causes for the life variability shown by retorts and other fire-clay material. A letter (signed by the Chairman of the Committee and President of the Institution, Mr. James W. Helps) is being sent out by the Hon. Secretary, Mr. F. J. Bywater, to a limited number of works, together with forms containing several questions, affecting materials, temperatures, and other conditions, which it is desired shall be answered by the recipients. Mr. Bywater will be pleased to send copies of the forms to any engineer not receiving one who has, or is in a position to obtain, information that will be of service to the Committee. The data are required for information and general report, without specific mention of works; so that there need be no hesitancy in replying with freedom—always remembering that this is a matter in which not only the interests of the gas industry itself are concerned, but the reputation of a kindred British industry is at stake. Following the digestion by the Committee of the information supplied, there is to be a conference with the manufacturers, in order to see how far the requirements of the gas industry can be met. It may be thought by some that the information asked for by the Committee does not go quite far enough; but the Committee have no doubt given full consideration to the scope their inquiry should take at the outset. The point that Mr. Bywater asks us to emphasize chiefly is that there shall be as little delay as possible in replying to the inquiries, so as to facilitate the work of the Committee—work that is being carried out for the common behoof.

A Gas-Works Purchase Arbitration.

The relative largeness or smallness of the total amount of money at stake has, it will be admitted, nothing at all to do with influencing the extent of the interest attaching to a gas-works purchase arbitration. The questions that are of general importance are those of principle; and, of course, when they arise they do so altogether irrespective of the size of the works to be acquired. Therefore though in the transfer to the Prestatyn Urban District Council of the local gas undertaking, which is the property of Lady M'Laren, the capital sum involved cannot under any circumstances be any very heavy sum, probably just as many points of general applicability cropped up in the course of the arbitration as would have been the case had the amount at issue been ten

times as great. It is for this reason that the proceedings, extending over two days, are reported at considerable length in another part of to-day's issue. The duties of Arbitrator were undertaken by Mr. Corbet Woodall for Lady M'Laren and Mr. E. H. Stevenson for the Council; while Sir Hugh Owen, G.C.B., acted as Umpire. A point about this purchase is that it is being entered upon at a comparatively early stage in the history of the undertaking, which was started seventeen years ago by the present owner's father, who had considerable property in the district, and so was interested in the development of Prestatyn, which was then no more than a fishing village. It was, of course, from the advantage to the place of possessing a gas supply that he expected his only benefit for some years to come, as there was no chance whatever of the undertaking, as such, becoming immediately remunerative. For two years there was a loss, then for several years merely a nominal profit; and afterwards, during the last two years, the results became substantial, though even then not sufficient was earned to pay the maximum authorized dividend on the capital created under the Provisional Order. This at the outset provided material for a fundamental difference of opinion between the parties; for, whereas the Council sought to base the purchase-price on the profits for the last completed year before the date of the notice to treat, it was strenuously argued on behalf of Lady M'Laren that the proper course would be—the notice to treat being dated September, 1909—to take the completed three quarters of the present year and to estimate (on a moderate increase which would in every likelihood be under the mark) for the remaining quarter. Other important points of difference were as to the capitalization of future probable profits and of back-dividends; and the number of years' purchase that should be adopted for arriving at the capital value of the undertaking. There was also a good deal of argument with regard to the items for repair and maintenance, the capitalization of the fittings and hire-purchase stove business, and a contention of the Council that 75 per cent. of the mains needed relaying at a greater depth.

The Valuations.

On behalf of Lady M'Laren, Mr. Henry Woodall (of Messrs. Corbet Woodall and Son) put in a valuation which was subsequently revised with reference to the bearing of one item—the capitalization of future profits. This valuation, as already mentioned, was based on the estimated profits in the year 1909—the profits actually earned in the first nine months being £339, added to which was a calculated profit (based on a smaller increase than had been experienced earlier in the year) of £182 for the last quarter. This made the estimated profit for the year £521, which he multiplied by 28½ years' purchase—making £14,848. In the revised figures, prospective profits were capitalized by multiplying £41 by 28½—deferred for one year—making £1124. Deducting £625 capital necessary to put the works and mains in a condition to earn the dividend, brought out a figure of £15,347, to which he added £2477, the present value of back-dividends, and 10 per cent. (£1782) for compulsory purchase—thus arriving at a total value for the whole undertaking of £19,606. On the other hand, Mr. S. E. Stevenson, who gave evidence on behalf of the Council, put in a valuation based on the profit shown by the last issued balance-sheet—that for 1908—which was £418. From this he deducted the £5 profit on fittings; £78 11s. for deficiency in the amount put that year to repair and maintenance and depreciation of cookers; and £19 2s. for an additional amount which he contended should be charged to rates and taxes—leaving a maintainable profit of £315 7s. This he multiplied by 20 years' purchase, arriving at £6307, and added £5 profit on fittings multiplied by 3—giving £6322. From this a deduction was made for lowering about three-fourths of the mains (which it was urged for the Council was a necessary work) of £656, less £220 capitalized value of the saving in leakage which would result from this lowering. This gave a figure of £5886, from which Mr. Stevenson deducted seventeen years' purchase of rental of hire-purchase stoves —£140, which gave a total value for the undertaking of £5746, *plus* an amount (which was left open) to cover the cost incurred in the re-investment of the capital. Any amount for prospective profits was ruled out by Mr. Stevenson as not being a proper item for capitalization, but only to be taken into account when considering the multiplier to be applied to the basis figure. Even should 10 per cent. be added to the value, for re-investment, it will be seen that Mr. Stevenson's valuation would not exceed £6320, as against Mr. Henry Woodall's total figure of £19,606. In fact, Mr. Stevenson admitted in cross-examination that the result of his valuation was to show that the works, after having been established seventeen years, and having now got into a paying condition, are not worth the money that has been expended upon them; his opinion being that they are heavily over capitalized. The Accountants who gave evidence were Mr. William Cash for Lady M'Laren, and Mr. W. B. Keen for the Council. In addition to the sum to be paid under the arbitration, the Council are to pay £250 towards the costs and expenses of Lady M'Laren in connection with the promotion of the 1909 Order and her opposition to the Council's Bill, so far as it related to the transfer.

The Eight-Hour Act in Court.

The interpretation to be placed on clause 3 of the Mines Eight-Hours Act, which has proved a contentious point, was last week the subject of an appeal to the Divisional Court—with a result which was the reverse of satisfactory from the men's point of view. This is what is known as the "Sixty Hour" clause, and provides that the time for which workmen may be below ground may be extended on not more than sixty days in any calendar year by not more than one hour per day. The employers regarded this clause as giving them power to request the men to work the extra hour; while the miners maintained that it placed no obligation upon them, but was merely an enabling clause permitting an extra hour to be worked during emergencies. Notices were posted up each week at the pit-heads requesting the men to work this extra hour; but they as consistently refused. It was understood a test case would be raised; and this was done, before the Pontypridd Stipendiary, who decided against a workman sued for damages. This decision has now been upheld by the Divisional Court. Counsel for the miners argued that, having regard to the fact that the scheme of the Act was an eight-hour day, it must be taken that it was to be eight hours a day, and not *plus* something else. In his judgment, the Lord Chief Justice remarked that *prima facie* the Act did contemplate that eight hours were to be spent underground, but for certain reasons an extra sixty hours a year were allowed. It could not be said that these sixty hours were not authorized by the Act. The men had been asked to work something which was sanctioned by the Act. The judgment of the Court was a unanimous one; and in view of this fact, the owners, at a subsequent meeting of the Conciliation Board, impressed upon the men's representatives that, in all fairness, they should now instruct the miners to comply with the demand of the collieries to work the extra hour per week. The leaders, however, declared that they could not advise the men to adopt this course, because the Miners' Federation of Great Britain had resolved that the whole of their constituency should not work the extra hour. Therefore South Wales could not adopt the course suggested without consulting the Federation of Britain; otherwise they would be violating the resolution unanimously agreed upon by that body. At first glance, this reads as though the Miners' Federation were to be regarded as absolutely above the law; but probably it is in reality only a question of procedure. Thus whether the Federation will consider the question as being definitely settled by the judgment of the Divisional Court, cannot at the moment be determined; but meanwhile the men's leaders have been reminded that damages for breaches of contract in this connection are accumulating.

Additional Water Powers for the Cardiff Corporation.—Owing to the late date (the 25th ult.) on which the Bill of the Cardiff Corporation received the Royal Assent, a copy was not available in time to be noticed in the articles dealing with the water legislation of the session which have appeared in the "JOURNAL." We have now, however, received a print of the Act from the Parliamentary Agents (Messrs. Dyson and Co.), and can give a brief indication of its contents. It authorizes the construction of an impounding reservoir in the valley of the River Taff Fawr, two conduits or pipe-lines, a new road, and several road diversions. A period of ten years from the passing of the Act is granted for the construction of the reservoir. From and after Jan. 1, 1919, the Corporation's Act of 1884 is to be amended in regard to the charge for water outside the city limits, by the substitution of 12½ for 25 per cent.; and the charge for water supplied in bulk by the Corporation to the Llandaff and Dinas Powis Rural District Council is not to exceed 9d. per 1000 gallons. The Corporation may borrow for the purposes of their water-works undertaking, including the purchase of lands and easements, £272,000. The money raised for constructing works is to be repaid within fifty years; but sixty are allowed for that borrowed for the purchase of land.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 837.)

BUSINESS on the Stock Exchange last week was quite on a quiet scale, as, of course, might only be expected in the week before Christmas. Some days were almost apathetic, with hardly anything doing at all. There was not a symptom of any strongly marked tendency beyond a fair amount of strength in some of the speculative departments; while as for the rest, movements were slight and unimportant. On the opening day, a dull feeling was apparent, though it lightened a bit before the close. The gilt-edged division was weaker, and Consols dropped $\frac{1}{16}$. Railways were rather on the down line. On Tuesday, business fell very quiet, and the tone was irregular. Good points were made by a recovery in the weaker markets of the day before. Wednesday was just as idle a day; but the tendency was fairly firm for most of the chief departments, though Consols had an exceptional fall of $\frac{1}{16}$. Thursday was generally a counterpart of Wednesday, with the addition of a favourable turn in the speculative markets. Friday was not so bright, and some degree of dulness supervened. This mended to some extent before the close, but the choicest things were not strong. Saturday was quiet, and with nothing much to mark except that the general tone was pretty fair. Business in the Money Market was enlivened by a brisk demand all through the week, which sent rates up materially. Discount was firm. In the Gas Market there was quite an outbreak of activity, aided largely by extensive dealings in the three Argentine undertakings in view of their amalgamation. The favour with which this measure was regarded was pointed by an advance in their issues, which was most marked in their debentures. In Gaslight and Coke, the ordinary was active and firm. All transactions were within the same limits as the week before—from 102¾ to 103½. In the secured issues, the maximum realized from 87½ to 88½, the preference 104 and 105, and the debenture 83. South Metropolitan was quiet and firm, changing hands at from 119¾ to 120⅝. The debenture made from 82½ special to 83—a rise of 1. In Commercials, the 4 per cent. was marked at 109 to 110, the 3½ per cent. at 103¼ to 104, and the debenture at 82½. Among the Suburban and Provincial group, Alliance and Dublin new was done at 11 15/16 and 12 1/16 (a fall of ¾), Brentford new at 190½ (a fall of 1), British at 42⅞ and 43, Hastings 3½ per cent. at 94, Ilford "A" at 145½, Lea Bridge at 120½, Portsea "C" at 122½, and South Suburban at 120¼. The Sheffield issues were put up 3. In the Continental companies, Imperial was more active at from 175¼ to 176¾, ditto debenture realized 95½, Union 95⅝, European fully-paid 24½ and 25, ditto part-paid 18¼, and Malta 4 13/16. Among the undertakings of the remoter world, Buenos Ayres changed hands at from 14⅛ to 14 7/16 (a rise of ½), Monte Video at 13, Oriental at 137½ and 138½, Primitiva at from 7 to 7¼ (a rise of ⅛), ditto preference at 5⅛, ditto debenture at from 97½ to 98½ (a rise of 3), River Plate at from 16⅝ to 17⅝ (a rise of ¼), San Paulo at 14½, ditto preference at 11⅜, and ditto debenture at 51 and 51½.

ELECTRICITY SUPPLY MEMORANDA.

Blaming Parliament—A Small Amount of Projected Legislation—Electricity and Smoke Abatement—The Latest Verdict of the Metropolitan Asylums Board—Cost per Thousand Candle-Hours—Increasing Temperatures of Lamp Bulbs.

ELECTRICAL people are for ever laying the blame at the doors of Parliament for many of the difficulties from which the industry has suffered. This is not altogether fair. Parliament did not invent the incandescent gas-mantle; Parliament has not contributed much to the cheapening of gas supply; Parliament has not invented new gas-lamps, gas cooking and heating stoves, and so forth. Parliament has done nothing to cause the thermal value of electricity to be so low, nor the efficiency of electrical heating appliances to be so poor. Parliament has had nothing to do with the hundred-and-one peculiar tariff schemes that have been born, and many of which have been abandoned in despair. All these things, and others, in which Parliament has had no concern have stood in the way of the realization of those buoyant hopes of the electricians of some few years ago. As a matter of fact, Parliament has befriended the electrical industry by being stubbornly niggardly in the loosening of the rope which keeps the gas industry within close bounds. The restrictions as to illuminating power and other matters are unnecessarily great; and we have had no revision of the Gas-Works Clauses Act since 1871. An Act suitable to modern conditions has long been over-due. The General Acts of the electrical industry were passed in subsequent years. But the "Electrician" asserts that it is generally conceded that the Electric Lighting Acts should have been amended ten or twelve years ago. But what about the archaic General Acts of the gas industry? However, there has been, after many years' wandering in and out of St. Stephen's, an Act passed this year that has broadened the scope of the electrical industry. Still there is discontent. For while it is believed that the Act will be of "considerable advantage" to the industry as a whole, there is yet a lingering regret that the wiring and fittings clause had to fall before an inappeasable opposition on the part of private traders and municipal trading antagonists. But we shall see what we shall see. The withdrawal of the wiring and fittings clause may be ultimately a handy excuse. If the industry does not make better progress in the future than in the past, it will be the simplest thing in the world to throw the blame upon the action that killed what is considered the one thing needful. Instead of perpetually complaining, better let the reviling of Parliament have a rest now, and see what actually turns up. Regarding the Private Electrical Bill legislation in the past session, it is said that it was uneventful as there were no electric lighting or traction schemes of first importance submitted to Parliament. If that is true of the past session, what of the coming one? There are fifteen or sixteen applications for Provisional Orders; and not one of them can be described as of first-rate magnitude. There are also about a dozen or so Bills containing electricity supply sections, four of which Bills are promotions by gas companies. These are the Chipping Norton Company, the Farnham Company, the Havant Company, and the projected Essex combination of the Bishop's Stortford, Harlow and Sawbridgeworth, and Epping Gas Companies. There is to be another attempt next session (the scheme in the past session failed through want of time) to carry a Bill to complete the project of constituting the London County Council the purchasing authority in respect of Electric Supply Companies' undertakings instead of the Borough Councils. The Companies concerned are the Westminster, the Kensington and Knightsbridge, Notting Hill, St. James' and Pall Mall, and the Central.

Our friends of the "Electrician" share the enthusiasm of the gas industry in desiring to abate smoke. The enthusiasm of the electricians is doubtless largely attributable as in the gas industry to the fact that its prime commodity can be used—though few choose electricity—for heating purposes. The subject is referred to in the "Industrial Supplement" of our contemporary; and the final words of the article are: "If anyone can prove to our satisfaction that this end [the abatement of smoke] can be attained better than by electrical means, we are quite willing to listen to reason." It is, up to the present, believed by the writer in our contemporary that electrical heating is "the best solution of the problem." We do not think it is; and as our friend is prepared to listen, we will give him as our main reasons for not seeing eye to eye with him the two of cost and inefficiency. We are, of course, sorry to have to say this, because with great magnanimity he confesses that "gas heating possesses the advantages of flexibility in adjustment and control, and can be satisfactorily used for cooking." But then the compliment is spoilt by what follows: "But it is expensive to employ this fuel for heating large quantities of water; and it is not quite so healthy as it might be. The unpleasant dryness mentioned in connection with steam heating is also a noticeable feature." Of course, electrical heating is proclaimed the superior; but there are those important aspects of cost and efficiency that are with wise discretion overlooked. Now when from a unit of electricity one can only obtain as many B.Th.U. as from 6 cubic feet of gas, what must be the result? We leave our friend to answer, and hope he will not subscribe to that piece of absurdity as to electrical appliances having some occult power of conserving and making better use of heat than gas appliances. These things have to be looked at from the practical and commercial points of view; for verily the householder will not consider much else. It is very curious, too, how pet notions, whether right or wrong, become with time magnified in some minds. There is that question of the supposed unhealthiness of gas, and the unpleasant dryness of the atmosphere. Our friends should study the latest gas appliances, and health and mortality statistics, to see whether the year-by-year progress in the consumption of gas is having any progressive dire effect. It ought to, according to electrical notions. Do let us deal with this subject in a practical way, and apply to it practical tests, and not always be taking a stand upon the thinnest assumption. As to the supposed expensiveness, too, of heating water by gas, we are quite at a loss to understand what is meant by this. Perhaps our friends will explain in some concrete form—for instance, by stating the cost of heating (say) 50 gallons of water to 110° Fahr., and the time occupied in doing so, starting cold, by a gas boiler and by the "Therol" electric heater; and after the 50 gallons have been drawn off, how long it will be before another 50 gallons have been heated up to that temperature ready for use. This curiosity on our part to have the matter definitely explained must be pardoned in view of dogmatic, if general, assertion. There is a little correction to be made in our contemporary's article. Gas-works are roped in with electricity stations as "smoke and fog producers." We should like to know the gas-works referred to; and whether our friends are aware that the furnaces in a gas-works are fed by coke. We come across some pretty little mysteries in our electrical contemporaries that would do credit to the fecund imaginations of a Rider Haggard or a Guy Boothby.

It was an oversight on our part, in dealing with the "Electrical Bulletin" of the London Electricity Companies last week, not to point specially to a matter that somewhat takes the gilt off the electrical use made of the report—dating back to the year 1901—of a Committee of the Metropolitan Asylums Board, in which electricity was glorified at the expense of—mostly, if not entirely—antiquated lighting by flat-flame gas-burners. The Editor of the "Electrical Bulletin" in his search for material has unearthed this old document, and has made use of it again, together with the guarded subsequent statement of the Finance Committee of the Board, that "after careful consideration of the figures, we are satisfied that the substitution of electricity for gas has been

generally economical." There is no talk of hundreds of pounds of saving in this sentence. In fact, the Finance Committee only hint at justification in as general a manner as possible. The Local Government Board Committee who considered the question of the substitution of gas by electricity in public institutions did not find anything in what the Metropolitan Asylums Board were doing to affect the pronounced opinion formed from their investigation that there is nothing to justify conversion from modern gas lighting to electricity in such places. But after all the fuss that has been made of the 1901 report and of the guarded announcement of the Finance Committee, it must have caused a little flutter among the electricians to have learned that yet another Committee—the Works Committee—of the Metropolitan Asylums Board have had the Engineer-in-Chief experimenting with incandescent gas mantles. Darenth Asylum has been the scene of the experiments, and there wasteful and inefficient gas lighting by flat-flame burners has been the vogue. The average weekly consumption of gas during the darkest weeks of the year has been 364,749 cubic feet. Conversion to incandescent gas lighting will only claim an initial expense of £273 11s. 6d., exclusive of fixing. The annual expense of mantle and glass renewals is estimated, as the result of the Engineer-in-Chief's experiments, at £50; the consumption of gas will be reduced by at least one-half; and three times the light will be obtained. In this respect, he has under-estimated, rather than over-estimated, the result; seeing that 5 cubic feet of gas consumed by a flat-flame burner per hour will only give a light of about 10 to 12 candles, while the same quantity of gas will afford in an inverted lamp a light of about 100 candles. In the darkest weeks of the year, the saving will be about £18 per week, and proportionately in the remainder. What have the electrical folk to say to the resolution of the Metropolitan Asylums Board to carry out the conversion?

A paper that Mr. F. H. R. Lavender has read before the Birmingham Local Section of the Institution of Electrical Engineers, has as a secondary part the results of some tests made to determine, as far as possible, the cost of illumination with metallic filament lamps. It appears that in the investigations six lamps of six different makers were taken; and in the following table there is a comparison, and below are some figures for carbon lamps extracted from a paper read before the Institution some time since.

Lamp.	Initial Candle Power.	Volts per Cent.	Useful Life.	Mean Efficiency.	Candle Hours.	Cost per 1000 Candle-Hours.		
						Renewals	Current.	Total.
			Hours.			d.	d.	d.
Set 1 . .	21·50	105·0	970	1·87	22,200	1·350	7·50	8·850
2 . .	24·20	105·0	1500	1·45	32,400	1·300	5·80	7·100
3 . .	30·00	107·5	2300	1·29	67,464	0·640	5·16	5·800
4 . .	28·50	102·5	2000	1·32	53,138	0·790	5·28	6·070
5 . .	31·20	107·5	1900	1·34	47,500	0·880	5·36	6·240
6 . .	26·50	105·0	2350	1·22	55,770	0·750	4·88	5·630
A { No. 1 .	18·90 (H.C.)	100·0	1000	3·95	18,200	0·660	15·80	16·460
A { No. 2 .	18·70 (H.C.)	100·0	1000	3·25	18,000	0·670	13·00	13·670
B { No. 1 .	15·10 (E.C.)	100·0	1000	4·94	14,560	0·619	19·75	20·369
B { No. 2 .	14·95 (E.C.)	100·0	1000	4·06	14,400	0·628	16·25	16 878

The cost of energy was taken at 4d. per unit. From the tests it appears that the cost of lighting with metallic filament lamps amounts to an average of about 6·2d. per 1000 candle-hours. If tantalum lamps are used, the cost is about 8·8d.; and with carbon lamps the cost is still greater. In the case of metallic filaments, 85 per cent. of the cost is paid for energy consumption, and 15 per cent. for the lamp itself; while with carbon lamps this latter item only amounts to 5 per cent. of the whole. The foregoing figures being laboratory ones, and not derived from ordinary use, may be regarded as the best obtainable; and, with the lamps running under these favourable conditions, it is seen that the cost of current alone is, in four out of the six sets of metallic filament lamps, per 1000 candle-hours, between 5d. and 6d. In the case of the ordinary inverted gas-lamp, 1000 candle-hours are realizable on a consumption of 50 cubic feet of gas, which, at 2s. 6d. per 1000 cubic feet, would represent 1¼d. The cost of renewals of the metallic filaments per 1000 candle-hours is interesting; but it will be remembered that the conditions are laboratory ones, and not ordinary.

Following these cost figures, more interest is found. Metallic filament lamps are often used for shop window lighting, and in close proximity to perishable goods; and so there was a desire to ascertain the outside temperature of the bulbs. For this purpose, the lamps were run at normal voltage and separately, so that there was no undue heating, owing to their proximity to one another. The following results (with a room temperature of 15° C.) were obtained:

Lamp No.	New.		After 1400 Hours.	
	Amp.	Temp.	Amp.	Temp.
1	0·390	68° C.	0·400	95° C.
2	0·298	48° C.	0·295	61° C.
3	0·327	53° C.	0·335	56° C.
4	—	—	0·337	79° C.
5	0·302	44° C.	—	—
6	0·281	40° C.	0·278	48° C.

It will be noted how the temperature of the bulbs increased with the life of the lamps; this probably being due to the presence of the black deposit. This black deposit also affects the illuminating power. The lamps were found to flicker more than carbon lamps when placed on an unsteady circuit, owing to the low terminal capacity of the filaments. Tests were also carried out to determine the spherical candle power, with the result that it was found this is about 22 per cent. less than the mean horizontal candle power, and the vertical candle power is only 18 per cent. of the horizontal.

PERSONAL.

Mr. J. W. C. Pennington, the Gas Engineer and Manager to the Colwyn Bay Urban District Council, has resigned his position. In a letter which was read at the monthly meeting of the Council on Tuesday last, he stated that he had decided to take this step "in view of the friction which had existed between himself and certain members of the Committee."

The Sulphate of Ammonia Committee are making plans for extending their propaganda work; and, with this in view, they have just lately appointed Mr. W. Popplewell Bloxam, B.Sc. (Lond.), as Scientific Adviser to the Committee. Mr. Bloxam has had a large and varied experience in connection with scientific work—both instructional and research—in the chemical sphere. Immediately before his present appointment, he had been occupied with work for the Government of India on the chemistry of the manufacture of Indian indigo. Prior to that, he was Professor of Chemistry in the Presidency College of the Government of Madras. Over the past twenty years, time has also been devoted by him to the publication of much original work. Mr. Bloxam is a graduate of the London University, a fellow of the Institute of Chemistry and of the Chemical Society, and a member of the Society of Chemical Industry. As scientific adviser to the Sulphate of Ammonia Committee, one line of work along which he is going to direct his energies is the conducting of manurial experiments through the various University Colleges and Agricultural Colleges of the country, as well as through farmers. Quite a new feature of the propaganda work is to be the delivery of lectures to farmers' clubs, on the advantages of modern intensive cultivation; and these lectures will be illustrated by some special lantern slides. At lecturing, Mr. Bloxam is an old hand; seeing that for about ten years he did a large share of the London University Extension work as a lecturer. We wish him success in his new sphere of labour.

OBITUARY.

The death occurred at Bournemouth on the 11th inst. of Sir Samuel George Johnson, the Consulting Solicitor to the Corporation of Nottingham. He obtained the appointment of Town Clerk in 1870, and in that office rendered the city 38 years' service during a period of great importance in its history. Owing to advancing years (deceased was born in 1832) he retired from the position in 1908, when he was appointed Consulting Solicitor, and was presented with the freedom of the city. In 1893, he received a knighthood in recognition of his work for the improvement of local goverment.

"Transactions" of the Institution of Gas Engineers.

We have received the "Transactions" of the Institution of Gas Engineers for the present year. The volume contains a full report of the proceedings at the annual meeting held in London in June, under the presidency of Mr. Thomas Glover, of Norwich, and an account of the excursion to that city, the visit to the gas-works, and the inspection of the high-pressure lighting. In connection with the technical matters which came before the members at the meeting, the volume includes the reply of Mr. E. W. Smith, on behalf of the Committee on Gas Heating Research, to the discussion on their report; and it is given in another part of the "Journal" (see p. 813). There is likewise included, as an appendix bearing upon Mr. Forshaw's paper on the "Illuminating Efficiencies of Carbon Monoxide and Hydrogen Used in Conjunction with Incandescent Mantles," the translation of the early observations of M. Sainte-Claire Deville on the variations in the illuminating power of an incandescent mantle which appeared in the "Journal" early in August last. There will also be found some correspondence on this paper. The contents of the volume include, as usual, abstracts of papers which appeared in various publications in the six months ending June 30; and also notices of the life-work of the members of the Institution who have died during the year. The other matter consists of lists of officers and Council, Committees, recipients of the Birmingham Medal, members, and officers and Committee of the Benevolent Fund. A list of the donors and subscribers to the fund is given, as well as the report and accounts. Following the rules of the fund are the Standard Clauses of Contract approved and recommended for adoption by the Institution in conjunction with the Society of British Gas Industries. The volume, which has for frontispiece a portrait of the President, has been produced under the editorship of Mr. Walter T. Dunn, the Secretary.

THE HAMBURG GASHOLDER DISASTER.*

By F. S. Cripps, Assoc.M.Inst.C.E.

All gas engineers will be intensely interested in the outcome of the inquiry as to the cause of the recent collapse of the large gasholder, with its vaulted tank, in Hamburg. As you rightly remark, any explanations founded on newspaper reports must be pure conjectures; and therefore the following observations are offered more with a view to pointing out the direction in which one must look for a solution, than any positive verdict on the cause of the catastrophe.

In the first place, let me endorse the opinion you express (*ante*, p. 725) of the risks attending these vaulted overground tanks, generally known as the Intze system of construction, and sometimes described as the "Continental system." The idea of constructing above-ground gasholder tanks, so as to utilize the interior for various purposes, although patented in Germany about the year 1883, was first patented in England by Mr. Frederick Gye in 1861. He suggested utilizing the interior of the tank for another gasholder. Strangely enough, this has been done on the Continent —the "Intze tank" being erected over the top of an existing gasholder, so as to enclose it. Although Mr. Gye may not have been an engineer, the credit of the invention is certainly due to him. Professor Intze, however, was the first to put the invention into practice, and he read a paper describing these structures before the Gas Institute in 1885. Later, Mr. W. T. Walker patented a modification of the system in 1890, which subsequently provoked correspondence between another engineer and myself (see "Journal," April 7 to May 19, 1891). In this correspondence, I expressed an opinion strongly adverse to the system of overground vaulted gasholder tanks. Later, the correspondence between myself and Herr Du Chattel in the "Journal" from Sept. 24 to Oct. 8, 1901, and with Herr Klönne in the "Gas World" of Dec. 21, 1901, and Jan. 4, 1902, and which followed the reading of Herr du Chattel's paper at Glasgow on the Amsterdam gasholder, brings out clearly that these Continental designs had been forstalled, in principle, by England many years ago. They have never met with favour, however, in this country, for the reason that the risk is too great; or, in other words, the game is not worth the candle. This brief statement relating to gasholders with vaulted tanks may not be uninteresting at the present time.

Now as to the disaster to the Hamburg gasholder, which was constructed on these principles. As you rightly remark, the reputation of a firm of such standing as the Berlin-Anhalt Engineering Company is sufficient guarantee that they would not knowingly neglect any and every precaution to avoid possible accident. At the same time, that there was an accident of some kind is obvious, although it may be difficult to fix the responsibility on any one. The most striking part of your account of the catastrophe (*ante*, p. 733) is contained in the following words, which are so graphic that I quote them in full:—

> About a quarter past three in the afternoon of Tuesday last, many of the workmen engaged on the buildings round about the gasholder observed a sudden lifting of the bell, or of the uppermost lift of the bell, followed by an equally sudden fall, and that by another lift. Foreboding no good therefrom, many of them took to flight, climbing or jumping down from the roof framings on which they were engaged.
>
> The holder meanwhile sank once more, and a quantity of the water in the cups was forced out. At the same time, from beneath the holder and above the concrete ring, a large flame issued on the side that was nearest the town. At the moment also, enormous tongues of flame sprang out from the vault of the under-structure of the tank, destroying everything round about which was combustible or susceptible of injury by fire. The whole sub-structure of the gasholder, which consisted of strong iron girders with radial ribs and lateral ties, covered with masonry (cement concrete) became penetrated, and everything contained in the vault, including the canteen and kitchens, was at once buried in its ruins. Above it, the large volume of about 3½ million cubic feet of gas streamed out, burning into the open, illuminating everything to a great distance with its glare, and producing enormous clouds of smoke. In the immediate vicinity, the "explosion" gave the impression of a small earthquake; but there was no violent concussion, as the outflowing burning gas was not mixed with air. The enormous tongues of hot flame that roared forth from the arch of the sub-structure stretched across the whole length and breadth of the space intervenining between the retort-house and the new coal-stores to the buildings on the opposite side.

Now, it is impossible for a gasholder bell to rise "suddenly" except as the effect of some addition to the internal lifting pressure; and upon consideration it will be seen that the only means by which this pressure can be suddenly produced is by explosion. Further, this explosion must take place below the crown of the inner lift. An explosion cannot occur unless there be an explosive mixture. Therefore, if the account be true as to the sudden rising of the holder, it is evident that an explosive mixture of gas and air was contained either in or below the holder. Did such explosion occur inside the holder? Or, was it below the vaulted roof of the tank? To deal with each inquiry in turn.

In your report, you mention that the gasholder had been tested with air, and that the result was not very satisfactory. Nevertheless, gas was then put into the holder. Can it be possible that the air had not been sufficiently expelled from the crown of the inner lift when filling the holder with gas? Was it during the process of lifting the holder for the first time with gas that the accident happened? These are the first points to determine.

Assuming that the explosion occurred inside the holder by reason of the explosive gases issuing from some faulty place in the holder (whether it be in the cups or anywhere else is immaterial) coming in contact with a light, it does not mean of necessity that the explosion would be violent. The proportion of gas and air inside may have been only just over the borderland of safety, in which case the explosion may have been slight, compared with what it might have been. It may have been little more than a dull thud.

Any explosion, however, which was sufficient to suddenly raise a heavy gasholder a few feet, would cause a great rise in pressure, not only blowing the water out of the cups, but exerting temporarily considerable pressure all over the flat top or roof of the vaulted tank. In fact, it would be quite equivalent to the blow which would be caused by dropping an evenly distributed weight, equal to the weight of the inflated holder, from a height equal to that to which it was suddenly raised by the explosion. The flat top of the vault could not possibly resist such an addition to the normal load coming upon it, and which load in the ordinary way would not exceed the distributed gas pressure when the holder is fully inflated, *plus* the weight of the tank roof with (say) 3 inches of water all over it.

Now, the sudden addition of such an unexpected distributed pressure all over the flat top of the vault would at once cause it to collapse at the same instant as the holder was blown upwards. It might collapse bodily; or the weakest areas alone might burst downwards, leaving the more substantial framework standing. In any case, the shallow layer of water would be quickly released, and the gas would as quickly follow, being thrust down by the descending lifts of the holder. The gas pressure would at first force a body of air before it through the arched openings of the circular wall of the tank, and would then follow in "tongues of flame" as described.

As to the locality of the explosive gases and the manner in which they were ignited. It is, of course, well known that, in filling a gasholder for the first time, gas, being lighter than air, passes to the top of the crown, displacing the air, which latter, passing downward, floats, as it were, on the top of the water in the tank (unless a special vent-pipe, reaching to within an inch or two of the water, has been provided for its emission). The air then gradually diffuses with the gas and forms an explosive mixture, at any rate just above the water level. Now, if this comes in contact with a light, it is evident an explosion must follow, although, owing to the almost pure gas in the upper part of the holder acting as a buffer, it may not be very terrific when looked upon as an explosion pure and simple.

It is said that the disaster at Hamburg occurred just as the third lift was cupping or uncupping, and it is suggested that the cup may have "blown." When cupping or uncupping, the cup is at the water level. If, then, an explosive mixture were present on the top of the water inside the holder, in the manner indicated, it is evident than any escape of such gases coming into contact with a light might have been the cause of the internal explosion, and thus have caused the disaster.

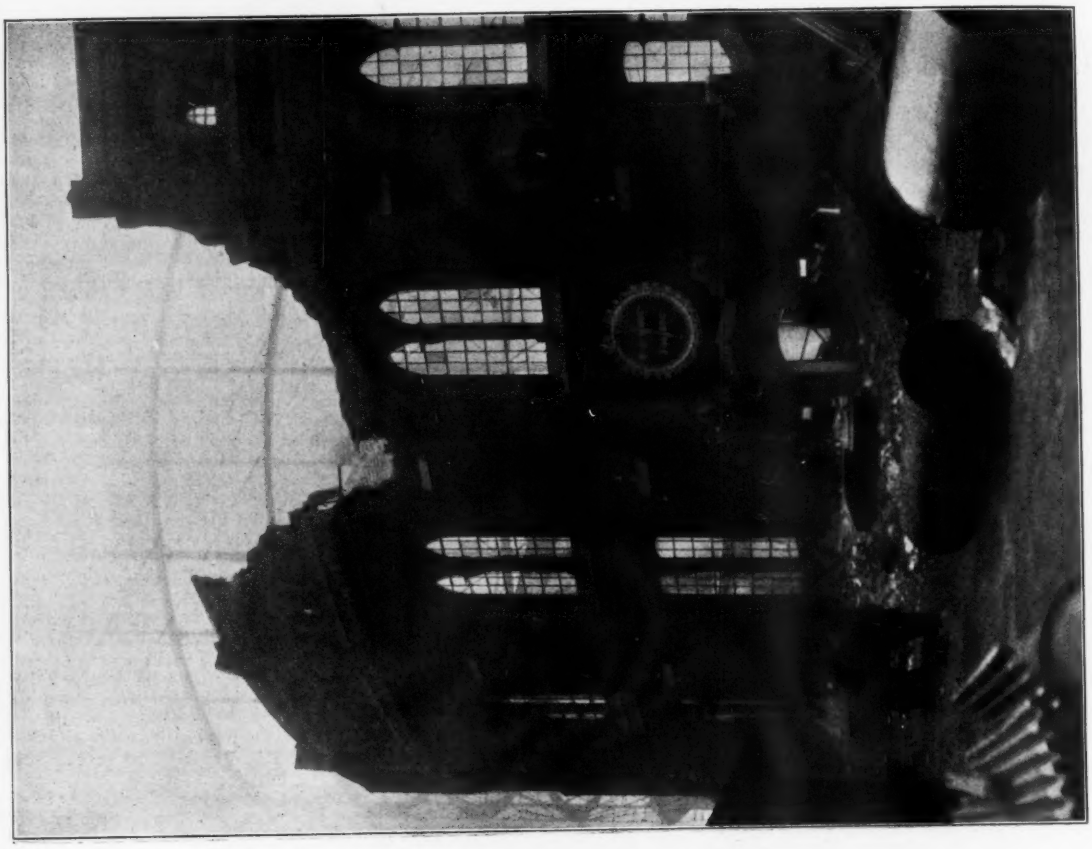
The only alternative to an explosion *inside the holder* causing it to rise suddenly is, that an explosion may have occurred *underneath the flat roof of the tank*—gas by some means having found access to the interior of the tank and mixed with the air. This would mean that the roof was not sound, that the water level was low enough to uncover the flat top, and that gas had penetrated it to a sufficient extent to form an explosive mixture of such strength that when it exploded it would not only burst and lift upwards the concrete roof of the tank, but lift the gasholder above it, as well. The explosion in this case would need to be much more violent than in the first case treated.

The questions which naturally arise are: Was the water level too low to cover the flat top of the tank inside? If so, was this due to faulty design as regards overflow level, faulty construction of the flat top causing leakage, or neglect in filling the tank to the overflow level, or in not maintaining the water at such a level as would ensure the tank roof always being covered with water? It would never be safe to depend upon the concrete roof alone for soundness; and therefore it is imperative it should always be sealed with water.

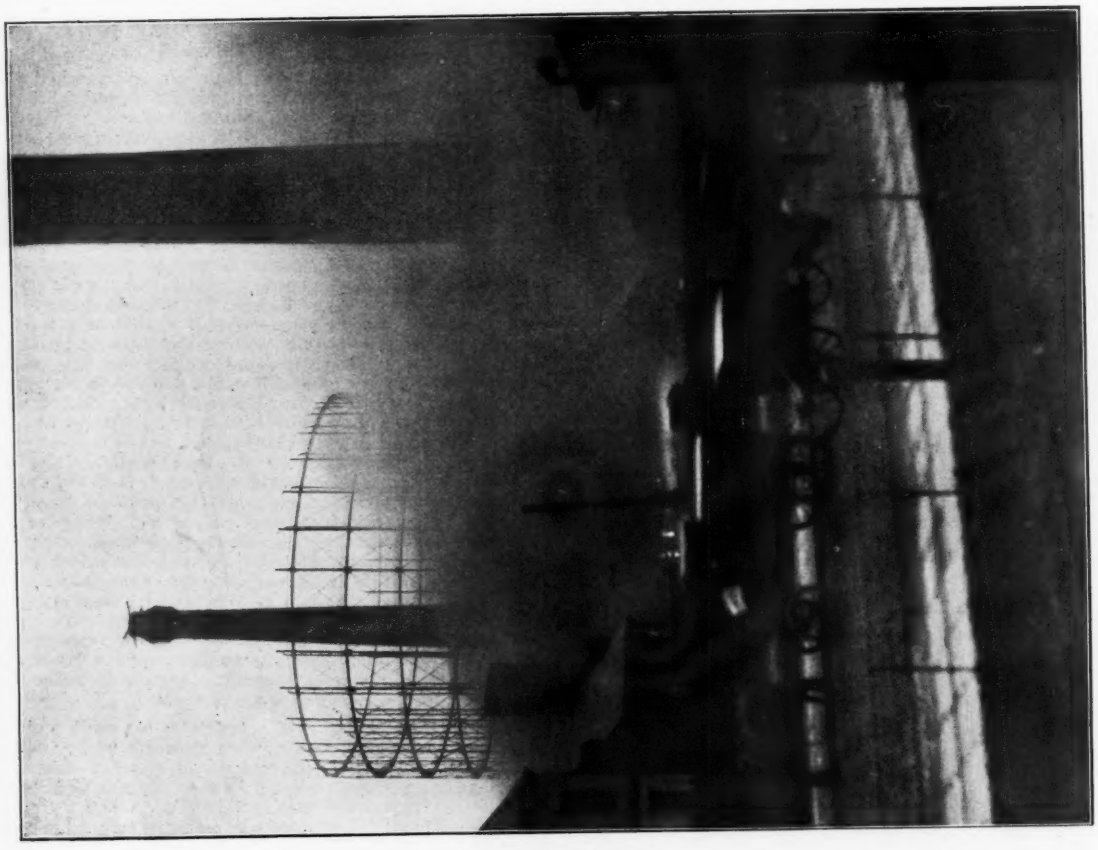
It is somewhat significant that in your account no mention is made of any water escaping from the tank. When the top fell in, water, although not great in quantity, must have followed it, unless the water level was too low.

The idea that the roof of the tank was too weak and succumbed to the ordinary load upon it, releasing the gas, which, mixing with the air in the vault, exploded, and thus raised the holder, may be dismissed as impracticable; because if the whole top had fallen in, there would have been a momentary falling of the holder, due to the released gas pressure, before the explosion occurred. But no such sudden drop in the holder appears to have been observed until after the explosion. Again, if the explosion occurred below the tank roof, it is practically certain a rush of air, and probably flame, would have taken place through

* This communication should be read in conjunction with the particulars received at a later date, as given in our editorial columns to-day, and in the article on p. 805.—Ed. J.G.L.



THE WRECKED HOUSE OF THE SMALLER GASHOLDER.



THE CONFLAGRATION THROUGH THE ESCAPING GAS FROM THE LARGE HOLDER.

the arched openings around the tank, before the holder would have been observed to rise. But nothing of this kind appears to have been noted.

Hence, so far as the information yet to hand may be depended upon, it would seem to indicate that the disaster was possibly due to the presence of an explosive mixture inside the holder coming in contact with a light through an escape of gas in the neighbourhood of the cups.

Speaking of cups. Much misunderstanding exists as to their action. They are for the most part designed by mere "rule of thumb." It is not too much to say there are scores of gasholders which "blow" when uncupping, particularly where the pressures thrown by the different lifts are heavy and the cups shallow. This, besides being a danger, goes to swell the "unaccounted-for gas." It can, however, be remedied very simply; and in a further article the writer proposes to show how it may be determined whether a cup will "blow" or not, and if it does, or would, the remedy for it.

THE GASHOLDER DISASTER AT HAMBURG.

THERE is not yet to hand much more information of a definite character regarding the terrible catastrophe which occurred at the Hamburg Gas-Works on the 7th inst., and of which a full report was given in the "JOURNAL" last week (p. 733). The "Journal für Gasbeleuchtung" of the 18th inst., however, has a brief account of the disaster, differing in some details from the earlier statements which alone were available at the time of our last Tuesday's issue going to press. We will indicate the points where our German technical contemporary's later information differs from that given by us last week.

It is gratifying, in the first place, to note that the number of those killed and injured through the accident is put at a lower figure—viz., 18 killed and about 23 severely injured. The construction of the base or foundation of the new gasholder of 7,060,000 cubic feet capacity was not included in the contract for erecting the holder; and it was not carried out by either of the firms who jointly secured the contract. The gas-works' authorities entrusted this work to the firm of Wayss and Freytag, of Hamburg. For the rest, the bell or holder proper was, as stated last week, constructed by the Berlin-Anhalt Engineering Company ("Bamag"), and the tank—including the concrete ring and the roof, and the guide-framing—was the work of Messrs. F. A. Neuman, of Eschweiler.

The filling of the annular tank with water was finished on Oct. 19; and the raising of the gasholder by means of air was then started. The bell had been thus raised to its full height by Oct. 28. It was then partially emptied, and again filled completely with air. At its highest position, it threw a pressure of 12·4 inches of water, which would be reduced by about 16-10ths when the holder was filled with gas instead of air. Thus, with gas, the pressure thrown by the holder at full height would be about 10·8 inches. The raising and lowering of the holder were controlled by observation of two pressure-gauges, charged with water, and also by a self-recording pressure-indicator. The diagrams obtained showed no fault in the guiding of the bell; and the cupping and uncupping of the lifts was satisfactory. A violent storm prevailed at the time the holder was at its highest position; and this caused fluctuations in the pressure of 1·2 to 2·4 tenths of an inch. The bell was left completely filled with air for about eight days, and was then inspected by the Hamburg authorities, in company with representatives of the contracting firms. This inspection took place on Nov. 9; and as a result the gasholder was, according to the official records, taken over that day by the authorities, without any reservation whatsoever. In the following days the holder was filled with gas, under observance of all proper precautionary measures; and the supply of gas from it to the city was begun on Nov. 25. The accident happened on Dec. 7, when the holder had been in regular use for twelve days, and four weeks after it had been taken over.

The foregoing particulars, from the explicit statement in the "Journal für Gasbeleuchtung," dispose of the report, given *inter alia* in the "Hamburger Nachrichten" and quoted in last week's "JOURNAL," that the first test of the holder under air pressure had revealed unsoundness. As, moreover, our technical contemporary makes no mention of the escape of gas in the first instance from the outside of the gasholder, which seemed to be indicated by the reports in the Daily Press, we will give its account of the occurrence in a practically *verbatim* translation.

"Shortly before the catastrophe, the second lift of the holder had cupped with the third, so that the contents of the holder then amounted to about 3,500,000 cubic feet, and the pressure thrown by it was about 8·9 inches. By some circumstance which up to the present time has not been cleared up, the level ceiling of the tank—which separates the air space inside the tank from the gas space, and which, in order to ensure it being gas-tight, was covered with a layer of water about 6 inches deep—must have developed a crack, through which the gas contained in the bell could pass into the space below, and thence through the openings in the foundations of the base of the annular tank into the open. The gas then in some way, which also has not yet been ascertained, caught fire, and the whole contents of the holder were completely consumed in large tongues of flame issuing from the openings in the annular base. The central flat ceiling of the tank and its sustaining framing fell in, while the annular tank itself and the guide-framing remained in position. The sides of the gasholder bell sank down into the annular chamber of the tank, and the crown buckled inwards; so that it now presents the reverse of its former shape. The ruins of the roof structure were piled up in chaos in the vault within the tank, throughout which fire-bricks and other fire-clay goods were stored. The neighbouring gasholder, of 1,765,000 cubic feet capacity, which is enclosed in a house, was involved by the outbreak of flames. The felt or fabric roof over this holder took fire, and the burning fragments of the roof fell in on to the bell of the holder and split its crown. The gas in this holder was wholly burnt out in a brief space of time, causing partial destruction of the brickwork and masonry."

Our comments on the fresh light which this account of the happenings throws on the cause of the disaster will be found on another page of to-day's "JOURNAL." For the rest, we learn that Herr Strack, the member of the Senate whose position appears to correspond to that of the Chairman of the Gas Committee of an English municipality, has reported that the Hamburg gas authorities are protected by insurance in so far as material loss and damage are concerned. Compensation for the victims of the catastrophe is provided for by their accident insurances; and if these should not be adequate, the authorities or the Municipality will give supplementary assistance.

After the accident, the contracting firms are reported to have gone over again in their own offices all the calculations for the construction; while they have retained for an expert investigation of the roof-construction the services of Privy Councillor Müller, Professor and Doctor of Engineering at Breslau, and Professor Boost, both of whom are of the Technical College at Charlottenburg. The Public Prosecutor's Office has called on Mr. Körting, the General Manager of the Imperial Continental Gas Association's works at Berlin, to act as technical adviser in the matter. Until the opinions of these authorities have been given, the "Journal für Gasbeleuchtung" considers that any expression of views as to the possible cause of the disaster would be premature, and that, in the meantime, judgment should be entirely suspended in regard to it. It promises to give in an early issue drawings and photographs of the large holder, with a detailed description of it by a technical man. It states that the work of reinstating the holder will be carried out in a few months. On the other hand, the "Hamburger Nachrichten" mentioned last week that the repair of the old holder and its containing house would be put in hand at once, and was expected to be finished in six months.

The "Hamburger Nachrichten" of the 11th inst. contained a report of the views of a technical man on the cause of the disaster, which gives a few details not included in the reports already given in the "JOURNAL." The new gasholder is stated not only to have been the largest on the Continent, but the first constructed in Germany with as many as four lifts. The outer walls of the tank are of steel plate 43 mm. (1·7 inches) thick; while the inner wall of the tank is of masonry (cement concrete). The roof of the interior chamber is said to consist of steel sheets carried by a T-girder structure resting on the inner wall of the tank. The roof is arched, and in the middle is covered with water to a depth of about 27½ inches. In order to test the soundness of the holder, it was completely filled with air, and the riveted joints were painted with soapy water with a view to discovering leaks. The air remaining in the crown was first displaced by gas before the holder was brought into use. At the time of the accident, the holder was filled to the second lift with gas, and in some manner, so far inexplicable, a hole was made in the steel sheets forming the roof of the interior chamber in which was the canteen. The water resting on this roof to a depth of 27½ inches was expelled by the gas, which thereupon passed, under the pressure of the holder, into the interior chamber of the tank. It escaped from the doors and the windows of this chamber, and ignited at the adjacent carbonizing-chamber settings. The gas then burned in the manner which has already been described. There was no explosion, but only a rapid combustion of the extremely large volume of gas, and the flames produced set fire to the woodwork of the roof of the adjoining gasholder. When the gas in this holder fired, there was again no explosion. In neither case was there any report or detonation, but only a violent hissing, such as occurs to a small extent when any quantity of gas is burnt.

The "Berliner Tageblatt" of Dec. 11 gives a report of a Berlin technical man who had visited the scene of the accident. He describes how the holder stands on a circular wall which rests on concrete piles. The openings in the wall have a clear height of 16 ft. 6 in., to admit of the passage through them of railway waggons. The roof of the interior chamber is of iron, and is carried by numerous lattice girders which run radially to a concrete column in the centre of the chamber. The chamber has a clear height of nearly 59 feet. From some unexplained cause, the roof of the chamber suddenly gave way. The lattice girders and the central masonry column were destroyed, and the whole of the gas in the holder passed into the chamber, and thence into the open, where it was ignited. The gas burning outside the holder developed enormous heat; but there was no explosion. The gasholder sheets were being painted at the time, and several painters were therefore on the galleries of the guide-framing. A few were able to clamber down the ladders or ironwork of the framing in time to save themselves, but others were burnt while on the framing. Several workmen engaged on the coal-store 40 to

60 feet away were also enveloped in the flames. The other gasholder, the roof of the house of which was fired, was only about 33 feet distant from the first in another direction. The roof of this holder was constructed of wood and fibre. The height of the gasholder roof was about 165 feet, and was not accessible with the appliances of the fire brigade; while there was only one entrance into the interior space between the brickwork of the house and the gasholder. This explanation is given of the inability of the fire brigade to quench the flames of the roof so as to save the second holder. The Berlin report also agrees that there was no explosion in the case of either holder.

AN IMPROVED FORM OF AERORTHOMETER.

By A. G. Vernon Harcourt, F.R.S.,

One of the Metropolitan Gas Referees.

The aerorthometer was originally designed for the use of chemists who collect and measure gases over water. It is placed with its bulb by the side of the graduated tube which holds the gas. When the volume of the gas has been read off, the water level inside and outside the tube being the same, and the aerorthometer has been read, the reading of the volume is divided by the reading of the aerorthometer. The quotient is the volume which the gas would occupy if the barometer stood at 760 mm. and the thermometer at 0° C. The same method of correction to standard conditions was made applicable to gas measured by passing through an experimental meter, by adjusting the scale of the aerorthometer, to give what the volume of the gas would be when measured over water with the barometer standing at 30 inches and the thermometer at 60° Fahr.

In testing-places provided with a system of heating by gas governed by a thermostat, there was little difference between the temperature of the air of the room and that of the water in the meter. Accurate measurements can only be made under these conditions. If the room has been cold through the night and is then warmed, the temperature of the water in the meter will rise much more slowly than that of the upper part of the meter-case and, to a less extent, of the gas within it. Consequently the temperature shown by a thermometer whose bulb is in the gas will be higher than was that of the gas when measured in the quarters of the meter-wheel. But since the gas on its way out is under a roof of higher temperature, but over a floor and in contact with a wheel of the temperature at which it was measured, and this for a very short time, the error is not likely to be great, and is certainly less than if the gas were assumed to be of the same temperature as the air of the room.

Fig. 1.

For this reason, it would be better for the bulb of the aerorthometer to be within the meter; and when it was first brought into use to simplify the correction to a standard of the measurements of coal gas, several attempts were made, with the help of the late Mr. Sugg, to give it such a form that its bulb might be placed within the meter. But in these the instrument was liable to be deranged when the meter was moved, and so the attempt was abandoned.

About three years ago, it occurred to the writer that an aerorthometer might be made with the advantage, for the end in view, of having its bulb at the bottom. Since then this form of the instrument has had a prolonged trial both at this office and at Messrs. Griffin's in the Kingsway, to whom the making of it has been entrusted. The readings agree very accurately with those inferred from simultaneous readings of the barometer and thermometer and a reference to the tabular numbers given in the "Notifications" of the Gas Referees.

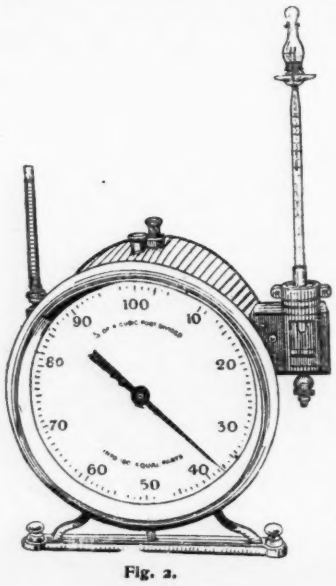


Fig. 2.

In the "Notification" for the coming year, this instrument is described and figured; and I enclose herewith a copy of the description and figures. While we think the new form of aerorthometer better suited to its purpose than the present form, we intend to sanction the use of either, for the present, by the gas examiners; hoping that many of those who are interested in the measurement of gas may make a trial of the new instrument and may report their results.

The reason for the use of hydrogen rather than air as the gas whose changes of volume the instrument shows, is that hydrogen is less soluble in water, and that it shares with common salt the curious property of being equally soluble in water of different temperatures.

Office of the Metropolitan Gas Referees,
66, Victoria Street, S.W., Dec. 18, 1909.

The extracts from the "Notification" of the Metropolitan Gas Referees referred to by Professor Vernon Harcourt point out that "a second form of aerorthometer, which has the advantage of being attached to the meter and of having its bulb inside the meter case, is proposed as a substitute for that now in use. For the present year the Gas Referees, while thinking the new form more suitable for use with a meter, are prepared to sanction the use of either form."

A description and illustration of the new form of aerorthometer, and its place in the meter has been added to the "Notification," and is said to give a more exact correction-figure whenever the water in the meter and the air near it differ in temperature.

The bulb of the instrument, having the form shown in section (fig. 1), is filled about three-quarters with hydrogen, and one-quarter with a dark liquid. Water blackened with ink has been found suitable for the purpose. The stem, which descends to the bottom of the bulb, is graduated above, over the range through which the liquid will rise with a low barometer in summer, and will fall with a high barometer in cold weather. For safe transport, and to check evaporation, the stem ends in a stopcock which is opened for two or three seconds only before each reading. Since, whenever the conditions have changed, air will enter or leave the stem on opening the stopcock, and the air passing out will generally be more nearly saturated with moisture than that which enters, if the tube opens directly into the air, a gradual evaporation will take place. This evaporation, being chiefly from the sides of the tube left wet by the fall of the liquid, would in course of time leave a stain upon the glass as well as diminishing the volume of liquid. The small bulb holding water at the top of the stem is for the purpose of saturating the air which enters.

The second illustration (fig. 2) shows a meter with the aerorthometer attached.

The Physical Society's Exhibition.

As mentioned in the "Journal" a fortnight ago, arrangements were made for the fifth annual exhibition of the Physical Society, held at the Imperial College of Science last Tuesday, to be open in both the afternoon and evening, instead of as hitherto, in the evening only. The change was apparently greatly appreciated, for there were large attendances on each occasion. Most of the exhibits of special interest to "Journal" readers were noticed last week (p. 742); but reference may be again made to the stand of Messrs. John J. Griffin and Sons, Limited, upon which were a Mahler-Cook bomb calorimeter, for determining the calorific value of coals, coke, oils, &c., and a Boys calorimeter, as used for testing the calorific value of London gas. Special interest attached to the last-named instrument, not only on account of the possible extension of its use in the near future, but because its designer (Professor C. Vernon Boys, F.R.S., one of the Metropolitan Gas Referees) was announced to give two demonstrations on "Soap Bubbles"—a subject which he invests with an interest that one would scarcely believe to be possible. It may also be mentioned that Messrs. Everett, Edgcumbe, and Co., Limited, showed a portable direct-reading lamp photometer for rapidly testing metal filament and carbon glow lamps. It is entirely self-contained in a portable case, and is so arranged as to be perfectly direct-reading in candle power. It has a wide range, and can be used in broad daylight. The Cambridge Scientific Instrument Company, Limited, in addition to the exhibits mentioned last week, showed some of Hohmann and Maurer's thermometers, which are specially designed for use in engine or boiler rooms for obtaining the temperature of superheated steam, feed water, flue gases, &c. Professor Boys' evening demonstration was followed by one on "Combinations of Mica and Selenite Crystals," by Professor Silvanus P. Thompson, F.R.S.

Institution of Municipal Engineers.—A general meeting of the Institution was held last Saturday week at Caxton Hall, Westminster, under the presidency of Mr. J. T. Pegge, of Durham. The following papers were discussed: "Superannuation and Security of Tenure," by the President; "Sludge Disposal," by Mr. W. C. Easdale; and "Short Methods of Calculation for Checking Reinforced Concrete Work," by Mr. E. F. Etchells. A dinner took place in the evening at the Gaiety Restaurant.

LUNGE'S "COAL TAR AND AMMONIA."

REVISED EDITION.*

IT is about nine years since the third English edition of Professor Lunge's standard work on coal tar and ammonia was issued. That edition of the work was in one large and somewhat cumbrous volume of 930 pages. The fourth and enlarged edition, of which a copy has just reached us, is in two volumes, extending to 1178 pages. There has been a general rearrangement of the whole work, and somewhat larger and clearer type is used in the new edition. It would appear, however, there is an actual increase in the amount of matter contained in the book of over 200 pages.

Professor Lunge's treatise on coal tar and ammonia has, since its first appearance in 1882, attained the position of the standard work on the coal tar and ammonia industries. It is an essential part of the library equipment of every technical man engaged or concerned in these industries. The present new edition can not be dispensed with by those technical men who wish to have ready to hand the latest compendium of the practices and the processes followed in tar and ammonia works, both here and abroad. Nevertheless, we think that those who have been continuously engaged in either or both the tar or ammonia industries since the publication of the first or the second edition of Professor Lunge's work will consider the latest edition a far less meritorious work than its predecessors. It is true that a certain amount of matter contained in the earlier editions which has now become quite obsolete is excluded from the new edition; but, in our view, a great deal too much of semi-obsolete and out-of-date information has been retained, and serves to make the present volumes cumbersome and unwieldy. There is no more serious defect in a technical treatise than the over-laying of the important and essential information which it contains with an enormous mass of material which has lost its early significance and merely serves to hamper the reader in his search for what is of present utility.

The disinclination of the author of a technical work, when he is faced with the preparation of a new edition of what has proved a successful and valuable handbook, to scrap a large part of his earlier text, is naturally very great. It is easier, and generally more in consonance with the views of his publishers, that he should allow the early text to remain and let his revision of it consist essentially in the addition of new matter in appropriate places, rather than in a re-writing of the text in order to incorporate the new material with what remains of real value of the old in the form which it would probably have taken had the same author been writing his book for the first time at the later date. It is too generally noticeable that the later editions of standard technical treatises have become encumbered with a great mass of matter which was once, but is no longer, relevant to the conditions of the art or industry with which the treatise deals. The custom of preparing new editions in this evil manner is further disastrous in that absolutely incorrect statements constantly survive in the later issues—such statements having been true only when the work was originally published. In the course of our review of the contents of the present edition of "Coal Tar and Ammonia," we shall have occasion to draw attention to many instances of these defects in it. Notwithstanding, however, its many blemishes, there is no work extant at the present time which deals with the technology of coal tar and ammonia in the same exhaustive and authoritative manner as this treatise by the distinguished Emeritus Professor of Zurich.

The first chapter is of an introductory character, and is comparatively little altered since the preceding edition was published. Professor Lunge has forgotten that since then we have passed into the Twentieth Century, for he still refers to the discovery of coal gas by Lebon and Murdoch as having occurred "towards the end of the last century." A diagrammatic comparison of the output of coal in the different coal-producing countries of the world from 1840 to 1897, which appeared in the last edition, appears again without having been extended to a later date, as might reasonably have been expected in view of the fact that the statistics for some nine more years are now available. In regard to the estimates of the production of coal tar in the United Kingdom, the latest figures given refer to the year 1902. So far as gas-works are concerned, it would have been easy to have carried on the estimates to a much later time. Russig's estimates, which are quoted, of the amount of coal-gas tar produced in the United Kingdom were 692,000 tons for the year 1900 and 755,000 tons for 1902.

An estimate made on practically the same basis as Russig's would give the production of coal tar in the authorized gas undertakings of the United Kingdom as approximately 770,000 tons in the year 1908. It would have been easy for Professor Lunge to have given such an estimate for the years 1903 to 1907, if not also for 1908. No estimate is given of the amount of carburetted water-gas tar produced in the United Kingdom, though the production of such tar in the United States in 1905 is estimated as being approximately 260,000 tons. In regard to Germany, more recent estimates are given; and it is stated, on the authority of Dr. Spilker, that 900,000 tons of coal tar were used in Germany in 1908, of which 700,000 tons were produced west of the Elbe. Apparently the amount of tar recovered from coke-ovens plant in Germany is considerably in excess of the production of gas-works tar; whereas in the United Kingdom the coke-oven tar still constitutes only a small proportion of the total make of tar.

The second chapter of the book treats of processes for obtaining coal tar and, in so far as it refers to the production of coal tar at gas-works, there is comparatively little change as compared with the former edition. An analysis, however, is now included of the tar produced by Dessau vertical retorts. Some comparative figures obtained by Dr. Bunte in 1886 regarding the products of distillation of different classes of German and Austrian coal are in part reproduced in tables printed only two pages apart. The second of these tables is palpably redundant. Another table showing the yields of different products on the distillation of a large number of English cannels and one or two ordinary coals is now of little value, as the cannels to which it mainly refers have almost gone out of use on English gas-works. A similar table dealing with the more important gas coals in use at the present day in this country would have been most valuable; but it is not provided.

A good deal of space is given up to projects for the recovery of benzol from coal gas, most of which projects had their origin at a time when benzols were worth three or four times their present value. So far as the gas produced on gas-works is concerned, these projects have lost whatever interest they once may have had. But their retention in Professor Lunge's book, and the supplementing of them by details of a few more modern processes, is justified by their bearing on the extraction of benzol from coke-oven gas. Nevertheless, we think the matter might have been better co-ordinated so as to show more clearly and succinctly the principles of the processes now followed in recovery coke-ovens. There is in this chapter a new sub-section, dealing with the estimation of benzene and its congeners in coal gas, which is compiled from recent sources. There is also a good deal of new matter relating to processes for the recovery of coal tar from coke-ovens. Here, as elsewhere throughout the work, we come across curious and rather confusing expressions, such as a statement that the gas produced in a certain coke-oven plant has a "heat value of 4300 to 4500 metrical calories." It would be almost as good sense to speak of lineal British thermal units! Of course, what the author means is calories per cubic metre. A fault which is especially conspicuous in this chapter, though it prevails pretty generally throughout the volumes, is that references to authorities and to patents relating to processes are not given even approximately in chronological order, nor, so far as we can see, according to any other systematic arrangement.

The tar from blast-furnaces, in which splint coal is used, is next dealt with, and while a good deal is said about the methods available for the recovery of tar and other bye-products from blast-furnace gases, the information in regard to the tar itself is inadequate and at times misleading. The particulars quoted of analyses and observations of blast-furnace tars indicate that, generally speaking, they have a specific gravity lower than unity; whereas, as a fact, a normal sample of Scotch blast-furnace tar may have a specific gravity as high as 1·10. It is obvious from the statements of the author in regard to blast-furnace tar that he can have had no personal knowledge of it in recent years, and that his sources of information are not reliable. Much the same may be said of the information contained in the book in regard to the tar produced in carburetted water-gas plants. This information is mostly taken from ancient sources, and is of no value at the present day.

The production of tar and tar products by the superheating of oils and vapours of oils is next dealt with, mostly from the standpoint of the production of benzols from crude or partially-refined petroleum products. Having regard to the small value of benzols at the present time, and the many alternative sources of them, these schemes have now no practical application. The somewhat similar, but more modern, processes for the production of a motor fuel by the cracking or distillation of crude petroleums, shales, and coal, do not appear to be dealt with in the book—perhaps because they have been regarded by the author as falling outside its scope.

The third chapter relates to the properties of coal tar and its constituents. The chapter opens with the following statement: "Coal tar is a black, more or less viscid, fluid of peculiar smell, of specific gravity of 1·1 to 1·2, usually between 1·12 and 1·15; London tar averages 1·2, and sometimes amounts to 1·215; country tars are lighter; cannel-coal tars still more so." Those who have practical knowledge of the tars produced at London and other English gas-works at the present time, as well as in the past, will know that these generalizations in regard to the specific gravity of coal tar are applicable only to the product of gas-works which still maintain the ordinary working heats of twenty years ago. The specific gravity of London tar has advanced to about 1·28; while the mean specific gravity of a dozen tars, selected—as representing the product from as many different gas-works in the South of England—from samples of tar which have recently been examined by the writer of this review, is 1·21. It is clear that Professor Lunge's acquaintance with tar as produced on English gas-works does not extend to recent years. And since the relative proportions of the different constituents of tar change with a change in its specific gravity, it is obvious that, in

* "Coal Tar and Ammonia," by George Lunge, Ph.D., Professor Emeritus of Technical Chemistry in the Federal Polytechnicum, Zurich, Honorary and Foreign Member of the Chemical Society, London, and of the American Chemical Society. Dr.Ing.(H.C.), of Karlsruhe, &c., &c. Fourth Edition, in two parts. London: Gurney and Jackson; 1909.

this important matter, the chapter is seriously defective; but for the rest we may say that it is generally well written and informative. One point which we think is not dealt with here, or in any other text-book with which we are acquainted, is the state of combination in which most of the ingredients of coal tar subsist in it. Are the so-called tar acids combined with the tar bases, or are they merely in mechanical admixture with the oils and other constituents of the tar? This question has an important bearing on the action of tar as a paint and preservative of wood and metal work.

The fourth chapter deals with the applications of coal tar without distillation, of which the first referred to is the employment of coal tar for the manufacture of gas. This portion of the book may be regarded mainly as an obituary notice of the Dinsmore process. There is no mention of the methane-hydrogen gas process as used at the Truro and other gas-works. Several pages are devoted to the use of coal tar as fuel, and the various appliances which have been employed or suggested for the consumption of coal tar in furnaces. We then come to the employment of tar for preserving timber, stone, iron, &c., for which purposes, naturally, a refined tar made from pitch and tar oil is preferred to a crude tar containing ammoniacal liquor and volatile oils. Contradictory views are quoted as to the preservative action of coal tar when used as a coating on wood work; and it may be remarked that one of the drawbacks of coal tar for this purpose which is mentioned—viz., the presence of naphthalene in it—is scarcely tenable in view of the fact that the naphthalene in creosote oil is now held to be a valuable constituent of the latter for the creosoting of timber. If naphthalene is harmful in the one case, it must be so in the other.

The use of coal tar in the manufacture of roofing felt is dealt with fairly well, but, of course, not so exhaustively as in special treatises. The employment of tar as a cementitious material in the formation of patent fuel and of blocks for special constructional purposes, is briefly dealt with; and another short section, which also appears for the first time in the present edition, relates to the use of coal tar for making and improving roads. Very little definite information, however, is given on the subject; and the adoption of tar painting on a large scale for roads in this country is not mentioned, nor its success indicated. The latest reference to English procedure is to Mr. J. George-Powell's report as given in the "JOURNAL" in 1905 (Vol. XCI., p. 554). Much progress has been made since the date of that report, as readers of the "JOURNAL" are aware. The next section of this chapter is on the production of asphalte and pitch from tar without distilling it. The processes referred to consist for the most part in the addition of various materials to the tar. Sulphuric acid is used by Coulson, Wendriner, and G. von Wirkner for the treatment of tar or tar oils with a view to forming therefrom a pitch or pitch-like substance; but it does not appear what measure of success has been achieved by such processes. After some subsidiary uses, such as the employment of coal tar, or of simple preparations of it, for antiseptic and medicinal purposes, the author passes on to the manufacture of lamp-black and soot, for which a prepared tar or creosote oil or pitch is preferable to crude tar. The furnaces in use for such manufacture are described, and some processes are mentioned for the more direct production of printers' ink from coal tar.

With the fifth chapter, which treats of the first distillation of coal tar, we enter on the portion of the work which deals with the working-up of tar to its various products. The processes of distillation employed, and the methods of treating and purifying the first products, have not been varied to any considerable extent with the change which has taken place in the character and quality of the crude tar in consequence of the changes in methods and heats of carbonization of the coal at gas-works. Therefore, this part of Professor Lunge's work, even where no alterations have been introduced since the publication of the previous edition, remains trustworthy as a guide to the procedure which is actually followed at large tar-works in this country and abroad. In some respects, however, the information given must be accepted with caution. Generally speaking, it applies only to gas-works tar and not to the tar from coke-ovens, carburetted water-gas plant, blast-furnaces, &c. For instance, cement concrete tanks for the storage of tar are, as stated, cheap and fairly trustworthy so far as coal tar is concerned. But they are readily pervious to water-gas tar; and it would had been well if Professor Lunge had included a warning on this point in his comments on the storage of tar. The problem of the dehydration of tar prior to distillation has become a more important one with the increase in the viscosity and density of the tar, as the modern high temperature tars retain in intimate admixture a much larger proportion of ammoniacal liquor than the tars produced at the low temperatures of carbonization which formerly prevailed. The references, however, to the modern methods of dehydration are rather brief and inconclusive, consisting mainly in quotations from patent specifications, without reference to results obtained in the practical application of the processes where they have been tried on a working scale. Nothing is said of centrifugal separators later than a quotation from a report by Herr Menzel in the year 1902. The remainder of the fifth chapter relates to the construction of tar-stills and the procedure for the first distillation of tar, and is, on the whole, satisfactory.

The reference to Köhler's determination of the relation between the specific gravity of tar and the percentage of free carbon which it contains, and which was quoted from Professor Lunge's work by Mr. G. M. Gill in last week's "JOURNAL" (p. 740), dates from the year 1888, and badly needs bringing up to date. The percentage of free carbon in many modern gas tars reaches 30 per cent., whereas the highest figure given by Professor Lunge (*i.e.*, from Köhler's researches) is 23·75 per cent., though, elsewhere, in the book it is stated that the carbon found in German coal tar by a particular method of estimation varies from 7 per cent. to 33 per cent. This method of estimation, however, is known to give results which are higher than the correct value.

The sixth chapter relates to pitch, and contains a good deal of matter which was not in the last edition, especially in regard to the manufacture of patent fuel or briquettes. The chapter is, on the whole, well written and more up to date than some of its predecessors.

In regard to anthracene oil, which is dealt with in the seventh chapter, and to creosote oil, with which the eighth chapter treats, there is not very much fresh matter introduced; but what there is is satisfactory, and these two chapters may be consulted with confidence. The chapter on creosote oil concludes the first volume of the new edition.

Chapter IX., with which the second volume opens, refers to carbolic acid and naphthalene. The treatment of these subjects is a good deal fuller than in the last edition of the book. The production of the various grades of carbolic acid, cresols, &c., and preparations of same, is exhaustively handled; but as only a comparatively small section of readers of the "JOURNAL" will be directly interested in the manufacture of these products of coal tar, we need not refer to this portion of Professor Lunge's work in detail. Naphthalene is a heading which will appeal to a wider circle; but, naturally, the information given in the book is chiefly in regard to the recovery of naphthalene from tar oils and its purification. Among the uses of naphthalene, the carburetting of gas therewith on the albo-carbon principle is fully dealt with, and appears to be regarded by the author as still of practical importance. Subsequently, however, the more modern use of naphthalene alone, or in association with liquid fuels, for driving internal-combustion motors is referred to, as well as a number of minor, but interesting, applications of naphthalene, quite apart from its use in the synthesis of artificial dyes.

The tenth chapter treats of light oil and crude naphtha, and, with the eleventh chapter, on working-up the light naphtha into final products, forms one of the most valuable sections of the whole work. A great deal of new and useful matter has been incorporated in these two chapters since the issue of the last edition of the book; and the result is very gratifying. A synopsis of the products obtainable from coal tar and a reprint of the official rules issued by the Home Office in 1903 for the prevention of accidents in tar-works, conclude the portion of the handbook which relates to coal tar, though a few pages of addenda at the end of the volume also refer solely to tar products. Including these, there are 815 pages devoted to tar; while the remaining 336 pages of text deal with ammonia. As we propose to defer notice of the author's treatment of the latter subject until next week, we may fitly at this stage sum up our views on his work in so far as it treats of coal tar and its products.

The level of excellence attained in the present edition is not so high as in the first two editions of the treatise, perhaps because the author is now less closely in touch with gas-works and tar-works, especially those of Great Britain, than formerly. There are numerous palpable defects in most of the chapters; but the faults of commission and omission are most conspicuous in those directly concerned with the raw material. Nevertheless, the work is indispensable to every technical officer on tar works; and most engineers and chemists of gas-works will profit by having it at hand for ready reference.

Extraction of Ammonia from Liquor.—According to a French Patent taken out by M. Herry, the specification of which is abstracted in the current issue of the "Journal of the Society of Chemical Industry," ammoniacal liquor, separated from tar, is treated with a current of carbon dioxide in order to convert ammonium sulphides into carbonate. Sodium carbonate is then added to decompose cyanides, thiocyanides, &c., and the liquor is concentrated. This liquor can be used for the production of ammonium-carbonate crystals, or the ammoniacal vapours can be mixed with the crude gas from the retorts to form ammonium sulphide, carbonate, thiocyanate, &c., which can be removed by washing; thus purifying the gas without using iron oxide.

A Gas-Engine Indicator.—We learn from a paragraph in the Engineering Supplement to "The Times" that Professor N. M. Hopkins, of the George Washington University, has, by an ingenious application of the principle of the electric pyrometer, developed an instrument to indicate the performance of an internal combustion engine. Instead of reading in degrees of temperature, it is graduated in arbitrary units which are proportional to the power developed and the speed attained. The thermo-couples are made of metals able to withstand the high temperatures existing in the cylinders of gas and gasoline engines, and are arranged to form part of the sparking plugs. Having a switch to connect the instrument to any one or all of the engine cylinders, the driver may ascertain exactly what each is doing, or if one is not firing. It shows the power of the engine, and indicates what conditions produce the highest efficiency; or it may be read to give the speed of the machine or the revolutions per minute of the driving-shaft.

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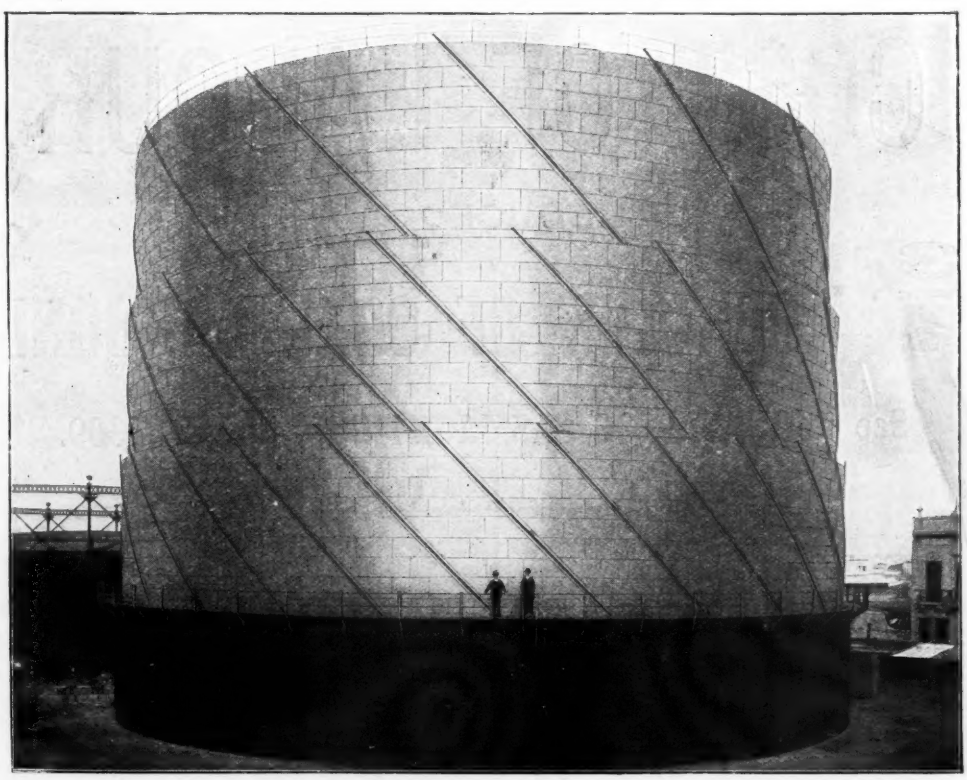

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PUBLIC WATER SUPPLY FOR PURPOSES OF FIRE EXTINGUISHING.

By C. W. S. Oldham,

Borough Water Engineer, of Ipswich.

[From a Paper read before the Association of Water Engineers.]

The great loss annually incurred through destruction of property by fire, together with the part that water takes in extinguishing fires, render the question of public water supply for fire-extinguishing purposes an important consideration. The law enacts that the undertakers of a public water supply shall provide water for fire purposes through public fire-hydrants free of charge; and that the pressure, unless otherwise stated in Private Acts, shall be sufficient to reach the top storey of the highest house within the limits of supply. The undertakers of a public water supply are also bound, at the request of the local authority, to fix and maintain in good order, hydrants for fire purposes; the cost of providing, fixing, and maintaining such hydrants to be at the expense of the local authority or town commissioners. The water undertakers are also bound to supply and fix, at the request and expense of the owners of any works or manufactory situated in any street in which there shall be a pipe of the undertakers, fire-plugs (to be used only in case of fire), as near as conveniently may be to such works or manufactory. Section 66 of the Public Health Act, 1875, states that every urban authority shall cause fire-plugs and all necessary machinery and assistance for securing an efficient supply of water in case of fire, to be provided and maintained.

Thus, although provision is made for public hydrants, and the water authority is bound to supply water through such public hydrants free of charge, no mention is made as to the quantity of water to be delivered in a given time; and the only reference to this point is the expression "efficient supply" in the section quoted above. This puts the responsibility for securing an efficient supply on the local authority and not the water undertakers. In fact, it is held, on a case stated, that "there is nothing in the Water-Works Clauses Act, 1847, to compel a water authority to provide at their own expense a pipe of sufficient size for an effective fire-plug."* Consequently, many mains have been laid that are of an insufficient diameter to give an adequate supply for fire purposes; and although in many towns much money has been spent in enlarging the size of mains to provide for fire, many small mains are still in use. In up-to-date practice, it is usual, when considering the size of new distributing and service mains, to give premier consideration to the question of fire supply. In order to allow for fire, no service-main should be laid less than 4 inches diameter, unless it be a very short length. The extra expense of providing pipes of larger diameter than are necessary for the ordinary domestic and trade requirements is, however, very generally borne by the water undertakers.

While considering the question of mains for fire supply, mention might be made of the large amount of money now being expended in some of the American cities. Brooklyn (New York) has lately put in 20 miles of mains of from 8 inches to 20 inches diameter for fire supply only, with special pumps capable of delivering 24,000 gallons per minute at a pressure of 300 lbs. per square inch. San Francisco has also decided to spend over a million pounds sterling on fire-mains only.

Private Fire-Hydrants.

The undertakers are not bound to supply water free of charge through hydrants placed on private property. In most towns it is customary to make an annual charge for each private hydrant, and to supply water for fire purposes free of charge—such hydrants being kept shut and sealed by the water authority. It is, of course, advisable to place such private hydrants on separate mains for fire purposes only; but in many cases hydrants are supplied through meters—being served by mains which supply water for trade purposes. In all such cases it is advisable to have a bye-pass of the full size of the main round the meter; a sealed sluice-valve being provided on the bye-pass. The necessity for such a bye-pass will be recognized when it is remembered that meters are liable, in case of heavy draught, to break down and stop the supply. Should a fire occur, the bye-pass valve is opened, the full pressure and flow of water is obtained at the hydrants, and any chance of damage to the meter, or stoppage of the supply of water to the hydrants through breakdown or centreing of the meter, is obviated. In connection with the undertaking of which the author has charge, an instance of complete stoppage of the water supply occurred at a recent fire; the failure was occasioned by the vulcanite piston of a 4-inch "Uniform" meter being smashed as a result of the heavy draught from several hydrants. Fortunately, a steam fire-engine was available, together with water from a neighbouring ditch; otherwise the consequences would have been very serious. Since this occurrence, all private mains in the town which are metered and supply fire-hydrants have been bye-passed; the cost of the bye-passes being charged to the consumers, and the valves commanding the bye-passes kept sealed by the water authority.

Automatic Sprinkler Installations.

It is not intended in this paper to describe in detail the construction of sprinkler installations; but it will be sufficient to say that, to all intents and purposes, they are fusible plugs placed on lines of pipes inside a building. The solder on the plugs melts as soon as the temperature generated by a fire is sufficient, the plugs are released, and water is poured on the fire. Sprinkler installations are officially recognized by all the Fire Insurance Companies, and are admitted to be a most reliable protection against fire. Many installations of automatic sprinklers have in recent years been fixed in mills, factories, warehouses, and shops; and the number is likely to largely increase owing to the fact that such installations have proved themselves of very great use in dealing with fires in their earlier stages, and also that the Insurance Companies make a substantial allowance (in some cases even 50 per cent.) off the premiums charged on such premises when not protected by sprinklers. The saving in premium in many cases covers the cost of the installation in a few years. The new State regulations in France stipulate that all theatre and opera stages must be protected by automatic sprinklers or drenchers.

Sprinkler installations are of interest to water authorities, inasmuch as they extinguish a fire in its incipient stage, and thus prevent a conflagration which might necessitate the use of many thousands of gallons of water for which no charge could be made. During the year 1908, 59 fires were extinguished by Grinnel sprinklers in the United Kingdom; the number of sprinkler heads opened in these cases averaged under ten for each fire. During the same year, the number of Continental and Colonial fires extinguished in the same manner totalled 137, the average number of sprinkler heads opened being also under ten for each fire. The ordinary average, however, is three; and it is estimated that the average time the sprinklers pass water is only 20 minutes—the consumption being less than 1000 gallons per fire.

All sprinkler installations have an automatic alarm valve and bell, which instantly come into operation in case of any water flowing through the pipes; thus a leak is revealed as promptly as a fire. That leakages are of rare occurrence, is proved by the fact that they can be insured against at the low rate of 1s. per £100 for damage done by water alone. To insure sprinkler systems against damage from frost, the "dry system" is employed. In this, the pipes are filled with air under pressure, which keeps closed a patent equilibrium valve shutting-back the water; the releasing of the air automatically opens the valve, which admits water to the pipes. The installation can be arranged so that both wet and dry systems can be used according to the season of the year. In some cases water for sprinkler installations is supplied by meter only; but considering that no water can pass without immediate notification on the alarm bell, and that the average quantity of water used is small, the author is of opinion that the supply of water for sprinkler installations is better met by a special lump-sum charge than by a meter supply. This view is supported by the fact that meters are liable to break down or get centred in working, and so interfere with the supply of water.

The author is aware that the meters which supply sprinklers usually supply the ordinary trade requirements as well. But although this as far as possible ensures the meter being always in working order, there is still the liability of the meter stopping the flow just when water was required for extinguishing a fire. Another point is that a much larger meter is necessary to meet the two requirements than would be needed for the trade supply only. In general, a 4-inch or 6-inch meter is required for a sprinkler

* *Rex v. Wells Water Company*, 1886. See "Michael and Will's Gas and Water," 5th edition, p. 321.

installation. In the case of the eight sprinkler installations and four drencher installations supplied by the author, the capital outlay for meters would have been over £500.

Drencher Installations.

Drencher installations may be described as a means of protecting property against fires spreading from adjoining buildings to the protected building. They consist of a system of pipes erected on the external walls of a building; the pipes being kept empty, and fitted with open drencher heads over each window and doorway on the outside of the external walls. In case of a threatened attack from fire on the surrounding property, water is turned on to the system by means of a valve on the ground floor outside the building, and which valve is sealed by the water authority. Cornice sprinklers or drenchers are used in a similar manner.

Another means of protection from fire, which has been found reliable and thoroughly practicable, is the May-Oatway system, which has been approved by the Insurance Companies and Fire Brigade experts, and operates by the action of heat, gravitation, and electricity. Water is only required after these natural forces have been utilized in giving the alarm of fire. Other automatic means of giving an alarm of fire, employing the melting of solder or a thermometer which closes an electric circuit, may be mentioned; but these and the May-Oatway system only affect the water authority in that they give an early indication of fire, and so save water.

A tabulated statement accompanied the paper showing the charges now in force for private fire-hydrants, sprinkler installations, and drencher installations in 31 important cities and towns. The charges for private fire-hydrants vary from 42s. to 4s. a year for each hydrant. In some towns no charge is made; while in others the supply is afforded by meter only. For sprinkler installations, some authorities supply these by meter only, some charge on the number of sprinkler heads, some on the superficial floor area of the buildings protected, some on the installation without respect to size, while others charge on the size of the connection to the public main. Again, in some cases no charge is made; and in one town a charge is made only when the installation is used for fire.

The table also shows the charges made by water authorities for drencher installations in twelve important cities and towns. Two of these authorities supply drenchers by meter only; one, the Metropolitan Water Board, bases the charge on the superficial area of the buildings protected; seven make annual charges of various amounts; and two—viz., Liverpool and Wigan—supply water free of charge.

The great variety of the charges adopted proves the desirability of deciding as to the most equitable basis upon which such charges should be fixed. In view of the moral, if not legal, responsibility of water authorities to, as far as possible, provide an ample and adequate supply of water for fire purposes, the author would urge that no obstructions should be placed in the way of property owners in the form of exorbitant charges for the privilege of having fittings for fire extinction connected to the water-mains; but that, where possible, such charges should be nominal in amount.

In conclusion, the author would suggest that, in order to ensure an adequate supply of water in case of fire, it is generally advisable to have the water-works offices in electrical communication with the fire stations, and that the Fire Brigade should also have similar means of communication with at least two water-works turncocks, who could assist by pointing out the position of the most suitable hydrants in each particular case, and, where both high and low pressure systems are in use, by turning on the high-pressure supply if necessary.

Discussion.

Mr. Oldham, in view of the paper having been taken as read at the summer meeting, was asked by the President to open the discussion by indicating its chief features. The author said the essential point was the very great discrepancy in the charges for fire extinguishing. Some towns were rather oppressive in their dealings with the private consumer who wanted a supply for fire purposes to his premises. From the table given in the paper, it was seen that the charges varied considerably for fire hydrants. The figures for automatic sprinklers and drenchers also varied very much. He had some eight installations in the town of which he had charge; but many of the manufacturers who had these installations—such as a big corset factory—did not like to pay £5 a year, though they got a 50 per cent. reduction on their insurance premiums. Some towns let private owners have these protective conveniences very cheaply; while some charged them, in his opinion, too much. The question was what ought to be fairly charged. A good deal, of course, depended upon the financial state of the water undertaking. If a water undertaking made a big profit for the corporation or company, they could afford to give the private fire hydrant supply for nothing. If, however, there was a rate-in-aid required, or a small profit made, they had to make a charge. He had suggested that the great variety of charges proved the desirability of deciding the most equitable basis upon which such charges should be fixed.

Mr. Herbert Hall (Montrose) wrote: "I have read with much interest Mr. Oldham's paper. The importance of a public water supply for fire extinguishing purposes is often overlooked when planning the distributing arrangements of a water service, or when making renewals of mains. When reconstructing and relaying the distributing arrangements in Montrose, some twelve or fourteen years since, it was decided to adopt 6 inch mains as the minimum size. From a number of tests made of the delivery of hydrants, it was found that a 4-inch main was practically useless if more than one hydrant was opened, whereas a 6-inch main would serve three or (in some cases) more without any serious diminution of supply or pressure. There are several practical points in connection with this subject upon which it would be useful to have further information, such as the best form of hydrant, the average distance between each hydrant, and the proper form of jet nozzle."

Mr. R. O. Wynne-Roberts (Westminster) said that, when he was at Cape Town, one difficulty they had was in assisting a neighbouring town in the matter of extinguishing fire, through the threads adopted in the hydrants of one district not corresponding with those in another. The Railway Department and other Government departments also had threads which did not correspond with the Corporation threads. With regard to the installation of drenchers, sprinklers, and hydrants, he should like to draw attention to one thing in connection with these appliances—that was, the contingency of complication of connections to various buildings. There were high-pressure supplies, low-pressure supplies, and often salt-water supplies in the same buildings. Under these circumstances, as would be well understood, there was some difficulty in preventing mistakes being made between one connection and another. To obviate this, he had letters cast in brass and inserted them in the pavement; so that the different supplies could be distinguished. This removed the tendency to mistakes.

Mr. W. G. Peirce (Richmond) remarked that, with reference to sprinklers, he had not had any experience in the Borough of Richmond; but he found great difficulty in providing a sufficient supply of water for the large fire-engines now in use, for extinguishing fires. In his borough they had a powerful engine capable of pumping 360 gallons of water per minute; but, unfortunately, the mains that were available over a great part of the borough were only 3 and 4 inches in diameter. It was impossible to supply sufficient water in the borough with 4-inch mains. These pipes had been laid down a good many years; and there was great objection to opening up the streets to substitute larger mains. This would prove an expensive matter. The discussion had come at the right time for those engineers who were contemplating laying new mains to take advice, and consider the question of recommending larger mains in future. The Metropolitan Water Board had been laying 6 and 7 inch mains where 4-inch used to be considered large enough.

Mr. Wynne-Roberts desired to add to his former remarks that a peculiar position they were placed in, in Cape Town, was in having the serious fire risks all located in a small radius—½ mile square. There they had tremendous conflagrations; some premises costing as much as a quarter-of-a-million to re-establish. In consequence of these extraordinary risks, he induced the Corporation to instal a fire-main, 8 miles long; and it ranged in diameter from 12 to 24 inches. By this means, they were able to deal with any conflagration that arose. It was sufficient to supply water under great pressure in every instance in that radius, without the aid of fire-engines.

Mr. Peirce further remarked that at Richmond they had a dual supply—river water—with independent pumps, for supplying water for flushing sewers, street watering, and trade purposes. These mains did not extend through every street in the borough; but with branches through side-roads

they practically covered the roads sufficiently to satisfy the requirements for this source of supply. With the dual system of supply, pumping direct into a dead-main (no reservoir), and keeping up pressure to 125 lbs. per square inch, had proved a great success in extinguishing fires.

Mr. R. B. Rigby (Bury, Lancs.) agreed with the author that no service-pipe should ever be laid of less than 4 inches diameter for fire purposes, as it was essential a good flow of water should be available at the commencement of a fire. With respect to private fire hydrants being supplied through meter, his Board had had cases where the meters had totally stopped, and thereby cut off the supply of water. They had had several meters removed which were in use for fire purposes, and the supply connected direct to the main to hydrants. In a number of cases, they had hydrants supplied with bye-passes round the meters as mentioned by the author. In his district, they had about 70 mills and workshops fitted with automatic sprinklers in consequence of the liberal allowance made by the Fire Insurance Companies; and in Lancashire as much as 70 per cent. discount was allowed off the premium where the pressure was 25 lbs. on the highest sprinkler, when the 2-inch wash-out valve was opened to the full—this valve being equal to eighteen sprinklers running. Under similar conditions, 65 per cent. discount was allowed for a pressure of 12 lbs. and 60 per cent. discount for a pressure of 10 lbs. He should like to point out that the Insurance Companies insisted on a tank being erected where there was only one main in proximity, but where there were two mains supplied from separate reservoirs, then the tank could be dispensed with. All the sprinkler installations in his supply area were connected direct to the main, and charged at the rate of £4 per annum for each installation. He was of opinion that it would be very detrimental indeed to have the supply afforded through a meter. The largest number of sprinklers supplied from one installation was 6483, and the smallest 57. In September, 1905, he recommended the Board to dispense with fifteen inferential meters which supplied sprinklers and trade purposes, and charge through rental for the sprinklers, and put smaller meters to supply the mills for trade purposes, with the result that there had been an increased revenue of £89 9s. 6d. per annum for the last four years.

Mr. Peirce asked whether the tanks were fixed on the buildings. At Richmond he suggested large tanks in the main roads, under the footpaths, to provide a supply of water to allow the fire brigade to have a good start with the large steamer.

Mr. Rigby said they had at present twelve tanks which were fed by a 6-inch main. They held 700 gallons; and, by their aid, the fire brigade could cope with their work. Under his arrangement, they could deliver 600 gallons per minute.

Mr. T. Molyneux (Stockport) remarked that there was one point about sprinkler installations that had caused trouble, which was that when sprinklers were attached to a main, with fire hydrants, immediately the fire brigade began to work on the main in the street, the sprinklers ceased. This was a difficulty which could only be overcome by having two mains. As to street tanks for the fire-engines, he had several in his town. The Watch Committee paid for them; and he put in a 6-inch main to feed them. They invariably did this where the pressure was low. As soon as the valve was opened to supply the tank, the water was gone from the hydrants. It was therefore where there was only a low pressure per square inch that these tanks were put in. A 6-inch valve would deliver a large quantity of water per minute, which would keep two, and even three, fire-engines going. Their charges for sprinkler installations were the same as in Manchester. It was a simple basis, depending upon the size of the main entering the building; and there was no trouble as to whether a man added or disconnected a few hundred sprinklers.

Mr. E. Antony Lees (Birmingham) said there was one point with regard to duplicate supplies to sprinkler installations. He should like to know whether any of the members had had experience of being asked for supplies from mains under different heads; the two being united in the same installation of sprinklers, and controlled by an automatic valve. The idea was that the normal supply should be from the high pressure; but if for any reason that should be off or reduced at any time, the lower pressure would automatically come into operation. The suggestion was made with the view of avoiding the provision of a high-level tank on the summit of the building itself. In Birmingham, they had declined to permit connections communicating within their system; and they required that, if they were provided, there should be a tank, and that there should be complete cut-off by means of the tank of communication between the two. As there seemed to be considerable experience of sprinkler installations—particularly in the towns in the cotton districts—one would be interested to know whether the point had arisen, and how it had been dealt with.

Mr. Molyneux said that, in their case, they had a back-pressure valve fitted with an automatic alarm; and as soon as the water commenced to move from any cause, it set the alarm off. If the water were passing from the high-pressure into the low-pressure main, the alarm would ring. The automatic valve he had only known a few years; it was quite a recent thing. They were insisting upon it in every sprinkler installation.

Mr. Antony Lees said he might say they had this valve. He had no doubt it was the same one. They had had it in operation at their works; and their engineer reported that it was not sufficiently reliable to justify him in permitting its installation. His view was that there was a danger of its being opened to such an extent as to reduce the pressure by frequently running to waste on sudden fluctuations of pressure, and without giving the necessary alarm.

The President: There was an alarm?

Mr. Antony Lees: Yes.

Mr. Wynne-Roberts said that, at Cape Town, they put in duplicate mains because of the reduction of the annual insurance premium, which the applicants saved by incurring the initial expense of these installations. Automatic back-pressure valves were fixed in every installation; and only in two instances had they any trouble, due to grit or dirt getting under the valve seating. But this did not interfere with the supply or pressure from the water-mains.

Mr. Molyneux remarked that the reason that in his town the Insurance Companies had insisted upon these duplicate supplies from mains or elsewhere was that when buildings—such as mills—were old, they would not stand the weight of the tank. The tank supply was taken by the Insurance Companies as a second supply.

Mr. Arthur Andrew (Oldham) said in their case they did not allow two connections from different mains having different pressures. They had had many applications for such duplicate connections; but in every case they declined to allow them. A high sprinkler tank must be put in for one supply; and they did not allow a connection direct to the sprinklers from their mains along with any connection from a donkey pump. They must be separate and distinct from different pipes. Regarding what was said as to the laying of pipes of larger diameter for fire purposes at the expense of the water undertakers, in their own case they insisted on the consumer bearing the expense of any enlargement of the pipe desired by the consumer, who got an additional discount allowed by the fire insurance companies.

Mr. J. S. Pickering (Cheltenham) said, as to protection from fire, he would like to refer to the relations existing between water authorities and fire insurance companies. The obligation, as the author had pointed out, was thrown upon the water authority of laying down supply-mains, and providing a sufficient supply of water for fire-extinguishing purposes. It was found, as a rule, that water companies provided smaller fire-mains than local authorities who owned water undertakings. That was because the companies had only the financial aspect to look to, whereas the local authority had to consider the good of the community at large, including protection against fire; and therefore fire protection was better carried out by a local authority than a water company. What he wanted to suggest was that where a local authority owned the water undertaking, better protection still would be afforded if, instead of property being insured with the different insurance companies, it could be insured with the local authority; thus making the water authority directly responsible for protection against fire. As the authority were compelled to provide larger mains, and an efficient supply of water for fire purposes, the public should get what benefit there might be from insurance premiums. The public body had to maintain not only the mains and supply water, but had to provide an efficient fire brigade; the latter being generally almost entirely for the benefit of the fire insurance companies. Occasionally, there might be risk of life in the case of fire; but in ninety-nine cases out of every hundred, there was no such risk. It was merely a question of the destruction of property; and it amounted to a commercial interest, instead of a question of life and death. The suggestion might be looked upon as somewhat socialistic

for municipalities to undertake fire insurance; but when it came to be thought out, it would be seen that it was to the advantage of the community as a whole, especially when one came to realize the amount of public money which local authorities were spending year by year for fire protection, and getting from it no direct benefit.

Mr. H. Ashton Hill (South Staffordshire Water Company) did not know why a question of water for fire supply should be made the ground for a comparison between company and corporation working. Mr. Pickering seemed to think that companies had only to make dividends, and corporations had only to spend money, and it did not matter which committee did it. But in the table they had before them in the paper, there was a large number of corporations who charged for fire hydrants. The Company with which he was connected did not make any charge at all, so that was a direct answer to Mr. Pickering's contention. He also seemed to be under the impression that authority undertakings were bound to lay mains for fire purposes. It would be found, as a matter of fact, although corporations did often lay mains specially for fire purposes, it was not the water department that did it. One of the speakers had told them it was the Watch Committee that gave the Water Committee the order to do the work.

Mr. C. Clemesha Smith (Wakefield) said, regarding the point of the laying of larger mains for the prevention of fire, by having a larger main a fire might be put out more quickly, and the whole or a considerable portion of the building saved. Thus not only was the money of the fire insurance company saved, but the money of the ratepayers as well; since, if the building were destroyed, no rates could be collected on it. Further, if a mill were enabled to go on working, all the operatives would be earning their money, instead of being idle, and becoming a burden on the rates. Also, by laying a larger main, they were, in a sense, safeguarding the lives of the workmen. These were arguments in favour of larger mains.

Mr. C. H. Priestley (Cardiff) pointed out that the question of the provision of water for fire extinction was more a matter of the Act of Parliament under which water authorities were working than anything else. He knew of places where the water authorities were bound to provide fire service, and special provision was made for it. In many other towns, he did not think they were called upon to provide it. Mr. Hill made a point of a case in which the Watch Committee had to pay for the provision. That might be so in some towns; but it was not so in his own case. The water authority had to pay for it, and were bound to put the hydrants at a certain distance apart free of cost.

Mr. Frederick Griffith (Leicester) said as one of those who had supplied some of the material to the author to enable him to compile the details of the paper he had submitted, he would like to point out the discrepancy that existed in various towns as to the charges for water for installations for fire-extinction purposes. They made no charge for water used for extinguishing fire. They did not meter the installations. The installations were off 6-inch mains. Mr. Lees had mentioned the question of duplicate connections. They had one case in which there was a supply from a high-pressure main, carrying 140 lbs. to the square inch, and another connection to the same installation carrying about 80 lbs. to the square inch. It was only within the last ten years they had introduced these installations. He was pleased to say they had had no experience yet of their efficiency, because they had had no disastrous fire; and he hoped they would not have one. Other people, especially in the Lancashire districts, where they had had fires, and so had had experience, spoke very highly of the efficiency of the installations; and no doubt there was more to learn upon the subject.

Mr. J. F. Cullen (Deal) understood that at Leicester they required certain notice as to the seal on the hydrant having been broken. What was the usual time that was allowed to elapse before the notice was given?

Mr. Griffith: As soon as possible afterwards. Next day, if it is in the night that the seal is broken.

Mr. G. O. H. Klopp (London) remarked that Mr. Oldham cited the case of the failure of a mechanical meter. It was the usual practice of his firm when mechanical meters were installed on fire supplies to advise the engineer to instal it on a bye-pass with a sealed valve on the main. They did so in this case; but, seemingly, their advice was not taken.

Mr. C. Clemesha Smith observed that he believed, under the Water-Works Clauses Act, the hydrants must be 100 yards apart. There was no alternative. Section 38 of the Act of 1847 said:

The undertakers, at the request of the town commissioners, shall fix proper fire-plugs in the main and other pipes belonging to them, at such convenient distances, not being more than the prescribed distance; or if no distance be prescribed, not more than one hundred yards from each other, and at such places as may be most proper and convenient for the supply of water for extinguishing any fire which may break out within the limits of the Special Act.

The President said the 1847 Water-Works Clauses Act enacted that the distance between fire-plugs fixed by a water company at the cost of the town commissioners should be not more than 100 yards apart. The Act was passed before water-works came much under the management of municipal authorities; and it was to compel water companies to put in a sufficient number of fire-hydrants. They had heard very little about the difference between the public and the private fire-plug. It had been touched upon because of the sprinklers; and the idea seemed broadly to be that, because these sprinklers were on private property, they came under the heading of private fire-plugs. The question of the enlargement of water-mains, so that there might be a sufficiency of water to put out fires, had also been touched upon; and a comparison had been drawn between a water company and an authority carrying out a water supply. Fire was a common enemy; and it seemed only fair the cost of fighting a common enemy should be met by the common purse. Water companies could not be expected to put in larger pipes than those required to meet their obligations to uphold a domestic supply in order to cope with any size of fire; and it seemed to him quite reasonable that water companies should say to public authorities: "If you are prepared to pay some proportion of the cost of enlarging these pipes in order that they may be successfully used for fire extinguishing, we are ready to enlarge them." They could not expect the purse of a water company to bear the cost of the larger pipes, which were *pro bono publico*. Sprinklers were quite modern things; and in fixing the charge there had been nothing to go upon in the past. They had now a list of the charges made and experience gained in other places; and he hoped they would now—whether company or corporation—try to arrive at a uniform charge.

Mr. Oldham, replying to the discussion, said in regard to Mr. Klopp's advice, it was not given to him, but to his predecessor. This was one of at least fourteen connections with mechanical meters on the fire-main; and he had since had bye-passes put round them. The argument put forward by users of the sprinklers or private hydrants was this: "You are bound to supply water free of charge through the public hydrants. If sprinklers are used inside the building, a fire will be put out so much quicker. Consequently, so much less water will be used, and so money will be saved." There was something in this argument. The average quantity of water used per fire through sprinkler installations was about 1000 gallons; while if there were no sprinklers inside the building, a couple of million gallons might be taken through the public hydrants for which no charge could be made. They argued that water was saved by installing these things in their premises; so that they ought not to be charged a high rent for the privilege of connecting to the public mains. As to the question of the two connections—the high and low pressure—so as to be able to do without an overhead tank, he thought the automatic valve that was put in on the installation, and a non-return valve on the low-pressure supply, ought to make it quite safe, so that the two waters would not be mixed, and especially was this the case if they had an alarm bell as well. Birmingham would not allow it; but he thought that was putting a big obstacle in the way of people who wanted to protect themselves from fire. He had intended to convey this idea towards the end of the paper, where he urged that, "no obstructions should be placed in the way of property owners in the form of exorbitant charges for the privilege of having fittings for fire extinction connected to the water-mains; but that, where possible, such charges should be nominal in amount." If a man was willing to pay a higher charge, but if he was told he should not have two connections, when his building was not strong enough to take an overhead tank, then the only alternative was for him to go to the heavy cost of building a tower. And, as before stated, with an automatic valve on the high-pressure, and a non-return valve on the low-pressure, there was little danger of the mixing of the two waters, and, in his opinion, separate

connections should be allowed. It was hard on the people who came for a supply for protection purposes to place unfair obstacles in their way. They were the people who paid the rates, and in the case of municipal undertakings owned a big share of the water-works. The question had been introduced as to breaking the seals. In the agreement that was signed, a clause was usually embodied to the effect that, if the seals were broken for anything but a case of fire, twelve hours' notice must be given. The seals might, of course, be broken accidentally. He had had trouble with private hydrants in mills where sacks were carried up and down. The hydrants were sealed with a type (they had done away with copper wire) and a lead seal; and the excuse was made that the man carrying the sacks broke the seal. There were many accidental breakings of seals in this way. They could not say much about these. He made it a rule to have a quarterly inspection of every private hydrant in the town. There was one interesting point that might be mentioned. Where in the City of London sprinklers and drenchers were fixed, and the pressure was not sufficient to cover the guarantee the Insurance Companies wanted, the supply was augmented by connection to the hydraulic power mains; and the arrangement, as worked, was very efficient.

MR. E. W. SMITH'S GAS INSTITUTION PAPER.

It may be remembered that it was arranged, at the last June meeting of the Institution of Gas Engineers, that the various points raised in the discussion that took place on the Gas Heating Research Committee's report and on Mr. E. W. Smith's paper, on "Open Gas-Fires," should be replied to in writing by Mr. Smith. The issue (last week) of the volume of "Transactions" of the Institution during Mr. Thomas Glover's presidency enables us to complete our report of the proceedings, by reprinting the reply made, as he says, on behalf of the Committee.

Mr. Smith writes: The criticisms on the Gas Heating Research Committee's report, when summarized, are:

(1) That the experimenting room was abnormally small, and that more useful results might have been obtained had its dimensions approximated to the ordinary living room.

(2) That the method adopted for the estimation of the percentage humidity of the air of the experimenting room—by means of the wet and dry bulb hygrometers—is inaccurate, and makes the humidity values unreliable.

(3) That it is extremely unlikely that a gas containing such a high percentage of nitrogen should give the calorific value stated in the report.

(4) That there was a third of the heat given off from the stove unaccounted for in Table I. of the report.

(5) That by using reflectors in front of the stove, the heat usually radiated towards the feet of occupants in the room would be directed objectionably towards their faces.

In reply to these criticisms, it may be stated:

(1) The experimenting room is decidedly small for general experimental work with gas-stoves; but it is highly satisfactory as a room in which the heat-balance of stoves may be determined. This was the primary purpose of the room. The size of the room does not materially affect heat-balance determinations; and with a small room the varying factors to be coped with are more completely under control than with a larger room. The size of the room was, as a matter of fact, determined by the resources the Committee had at their disposal.

(2) The relative humidities of the air inside and outside the room were obtained by means of wet and dry bulb hygrometers. These have been most carefully and accurately compared with those obtained by means of the Regnault hygrometer.

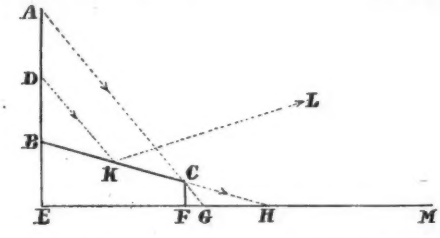
At 60° Fahr. there was no difference.
" 68° " the hygrometers read 1 per cent. low.
" 77° " " " " 1·5 " "
" 86° " " " " 2·0 " " compared with the Regnault hygrometer. The average error in the internal humidities was consequently 1·5 per cent., which is hardly sufficient to vitiate the results submitted in the report to the extent suggested by the critic. As the volume of air passing through the room during most of the experiments was fairly large, the hygrometers were tolerably well ventilated.

(3) The analysis of the gas used averaged for nitrogen the figure stated in the report. The calorific values were also as stated in the report. Probably the fact was overlooked that all gas volumes had been reduced to "0°C. and 760 m.m. dry," and the figures in Column D of Table I. were erroneouslv taken to be the calorific values of 1 cubic foot of gas at 60° Fahr. and 30 inches wet. The factor for the conversion of gas volumes at 0°C. and 760 m.m. dry to 60° Fahr. and 30 inches wet is 1·073, and from 60° Fahr. and 30 inches wet to 0°C. and 760 m.m. dry is 0·9324.*

* The figures in Columns C and D of Table I. appended, have been converted to 60° Fahr. and 30 inches wet, and are added at the side.

(4) A column for the "missing third" has been added to the table at the end of the report. This is the heat of convection originating directly from the stove. The total heat of convection produced by means of the stove, and found in the room, is higher than the figures given in this Column H_2, owing to a large part of the heat of radiation being converted ultimately into the heat of convection.

(5) The accompanying diagram will show that with the reflector (B C) that was used, only the radiations that would have struck the floor within 10 inches (E to H) of the foot of the stove (E) would be reflected, and not those rays that extend as far as the



feet of occupants in the room. A B is the front of the heater "fuel" surface (6 inches); D is its centre; B C is the reflector at an angle with the horizontal at 15°; D K L is the course of a ray emitted from the centre of a stove on to the centre of the reflector. This will approximately be the mean course of all the radiations reflected.

STANDARDIZATION OF GAS-MANTLES.

Writing on this subject in the pages of our American contemporary "Illuminating Engineer," the Editor (Mr. E. Leavenworth Elliott) refers to a paper, "Practical Applications of Illuminating Engineering," presented at the recent meeting of the American Gas Institute by Mr. Norman Macbeth, the Illuminating Engineer of the Welsbach Company of America, and again bringing up forcibly the question of standard specifications for gas-mantles. On this particular subject, Mr. Macbeth said:

> A Standardizing Committee of the Association, acting with the manufacturers of gas-lighting accessories, would seem to be a necessity. Mantles can then be required to meet specifications which have been determined by thorough tests to be satisfactory—standardized for size, colour, cerium and thorium content, strength, weight, and other points of importance. Mantles which show a depreciation of 10 per cent. in 1000 hours are certainly entitled to a different classification than the kind which will show a drop of 10 per cent. in 250 hours, and as much as 30 per cent. or (in lower grades) 60 per cent. in 1000 hours.

Mr. Elliott writes: The statements as to the variations in the quality of mantles will certainly be startling to the user, and probably also to a considerable number of illuminating engineers, and those concerned with the sale of gas. The condition is one which might be expected in a trade in which competition has been allowed to run on the question of price alone. Wherever such a condition exists, it inevitably follows that the efforts which should be devoted to the improvement of quality as well as the reduction of manufacturing cost are devoted wholly to the latter, with the result that goods are produced whose inferiority is limited only by the carelessness of the buying public.

The conditions in the mantle industry are in striking contrast with those in the incandescent electric lamp industry. In the former case there is no standard and little general knowledge as to quality. Result: A market flooded with goods that are expensive at any price. In the latter case, the most rigid standardization and specifications exist. Result: Lamps that are practically uniform in quality, no matter of what make, and at a price that is neither burdensome to the user nor profitless to the manufacturer. An electric lamp that gave comparatively as poor results in use as a gas-mantle whose efficiency runs off 60 per cent. in the course of its life, could not be marketed at any price. The subject is one which the Institute may well take into serious consideration. Poor mantles are a serious menace to the progress of gas lighting; and a gas company should no more countenance their use than would a central station the use of a worthless lamp.

There is no federal regulation at present requiring the chemical constitution and strength of a mantle to be stated upon the package, as in the case of prepared foods; and there is no prospect of any such law being enacted. The gas companies themselves, however, through their Associations, have ample power to enforce whatever specifications they may agree upon. They are in continual personal touch with every user of gas; and their facilities for educating the public in this respect are such as to completely dominate the situation if they choose. Or, the mantle makers themselves might accomplish the purpose still more quickly by agreeing upon a system of specifications, as the electric lamp makers have. Whatever way it may be most effectively accomplished, there is no doubt that the present practice of absolute irresponsibility on the part of the manufacturers as to the reliability of their product is prejudicial to the best interests of the gas industry, and means should be taken to remove the cause.

THE REFRACTORY MATERIALS COMMITTEE.

Forms of Inquiry.

THE Committee who were some time ago appointed by the Council of the Institution of Gas Engineers to investigate the question of the supply and use of refractory materials in the gas industry are arranging to circulate the following letter, signed by the Chairman (Mr. J. W. Helps, of Croydon), together with the necessary forms of inquiry. These inquiries are only being sent to a small proportion of the total number of gas-works in Great Britain and Ireland; but if any engineer who is interested in the subject does not receive copies, the Committee will be very glad if he will apply to the Hon. Secretary (Mr. F. J. Bywater, Saltley Gas-Works, Birmingham), when they shall be forwarded:

You are probably aware that some time ago the Council of the Institution appointed a Committee to investigate the question of the supply and use of refractory materials in the gas industry.

To assist further discussion on this matter, it is thought desirable to obtain comparative statements from a number of representative gas-works, with regard to the temperatures at which the plant is worked, the materials employed, &c. I shall therefore be glad if you will be good enough to fill in and forward to the Hon. Secretary the enclosed forms, together with any other information you may be able to place at the disposal of the Committee on the subject.

It is recommended that, where possible, the estimation of temperatures should be carried out by means of the Féry spiral pyrometer; and arrangements have been made with the Cambridge Scientific Instrument Company for the hire of these instruments where desired.

When the necessary information with regard to present practice is available, it is proposed to review the whole position, and confer with representatives of the manufacturers on the subject, to see how far the requirements of the industry can be met; and later to discuss the matter with the strong Joint Committee which has been formed this year, consisting of representatives from all the industries concerned in the manufacture and use of refractory materials.

It is hoped by these means to arrive at a better understanding between users and manufacturers, and thereby bring about a considerable improvement in the quality of, and the results obtained from, fire-clay material generally. The Committee have therefore every confidence in appealing to you for assistance in this matter.

Any further information required may be obtained from the Hon. Secretary of the Committee, Mr. F. J. Bywater, Saltley Gas-Works, Birmingham, to whom the inquiry forms should be returned when completed.

There are in all three forms to be filled in. The first of them asks for the following information: (1) Remarks and criticisms on material now available. (2) Sizes of ordinary bricks employed. (3) Sketch of cross section of retort giving radii of curves. (4) Would you object to the adoption of a standard pattern if a certain No. based on average in use were recommended for adoption? (5) Do you favour the drawing up of a standard specification for the manufacture of fire-clay and retort material in conjunction with representatives of the makers? (6) What method of testing refractory material do you employ? (7) Do you favour the foundation of an independent testing laboratory for the testing of refractory material?

The particulars required to complete the remaining two forms will be gathered from the headings, which are as under.

Coal Gas—Retort Settings.—(1) Works. (2) Maximum capacity per diem. (3) Number of beds of retorts. (4) Number of retorts per bed, type of setting, and disposition of retorts. (5) Angle of retorts. (6) Size, length, and thickness of retorts. (7) Highest and lowest observed working temperatures—(*a*) Retorts. (*b*) Combustion chamber. (*c*) Producer. (*d*) Regenerator. (8) Method of estimating temperatures. (9) Material used (moulded or segmented), and analysis if possible. (10) Usual life of retorts without patching other than pointing. (11) Total life with patching. (12) Total coal carbonized per setting. (13) Combustion chamber.—(*a*) Usual life. (*b*) Kind of material used, and analysis if possible. "Life" in all cases is understood to mean "total actual working days."

Water Gas (or Plants of a Similar Nature).—(1) Works. (2) Maximum capacity per diem. (3) Makers of plant. (4) Number of sets installed. (5) Highest and lowest observed working temperatures and time between same—(*a*) Generator. (*b*) Carburettor. (*c*) Superheater. (6) Method of estimating temperatures. (7) Life of generator lining without repairs, and usual repairs executed. (8) Total life of generator lining, and analysis of material if possible. (9) Life of carburettor without repairs, and usual repairs executed—(*a*) Lining. (*b*) Chequerwork. (10) Total life of carburettor, and analysis of material if possible—(*a*) Lining. (*b*) Chequerwork. (11) Life of superheater without repairs, and usual repairs executed—(*a*) Lining. (*b*) Chequerwork. (12) Total life of superheater, and analysis of material if possible—(*a*) Lining. (*b*) Chequerwork. "Life" in all cases is understood to mean "total actual working days."

Of course, any particulars given will be kept private, and be only used for the information of the Committee.

It is to be feared that the collection of all this material may take some considerable time, unless expedition is shown at the various works in obtaining the information required; and so it is to be hoped that there will be no unnecessary delay in the filling up of the forms.

MUNICIPAL TRADING IN GAS SUPPLY.

A SMALL treatise by the Right. Hon. Lord Avebury, P.C., on "Municipal and National Trading," was noticed in the "JOURNAL" about the time of its publication nearly three years ago.* The work appears to have been translated into German recently, and certain portions of it are reviewed very exhaustively, and data brought forward to controvert Lord Avebury's main contentions, by Herr Emil Schiff, of Grunewald, Berlin, in recent numbers of a monthly review "Technik und Wirtschaft," which is issued as a supplement to the "Zeitschrift des Vereines Deutscher Ingenieure." It is unnecessary in these columns to refer to Herr Schiff's statistics relating to railway and telegraph administration and some other branches of trading which are very generally national enterprises. In regard, however, to gas undertakings, which are in some countries almost wholly under municipal management and in others mainly or partially in the hands of private companies, it is interesting to notice what data Herr Schiff brings forward to show that Lord Avebury's conclusion that "in places supplied by companies gas is substantially cheaper than where it is in the hands of the municipality" is not justified except within a limited sphere of application.

It will be remembered that Lord Avebury quoted from "Field's Analysis" the prices charged per 1000 cubic feet of gas by eight corporations of places all situated near coalfields, and of eight companies supplying gas in places, four of which were near coalfields, and four far distant from coalfields. These figures are quoted by Herr Schiff, who then proceeds to give corresponding figures for a number of German towns in some of which the gas supplied is in the hands of the municipality and in others in private hands. It is worth while reproducing Lord Avebury's figures along with those of Herr Schiff. The latter are paired according to the size of the towns, and are taken from a German statistical annual for the year 1908.

Comparison of Prices of Gas by Municipal and Privately-Owned Gas-Works in England and Germany.

[The figures in brackets are prices for gas for power and heating purposes only.]

Municipal Gas-Works.	Per 1000 Cub. Ft.	*Gas Companies.*	Per 1000 Cub. Ft.
Nottingham (near coalfields)	2 6	Bristol (near coalfields)	2 0
Bolton ,,	2 6	Bath ,, ,,	2 1
Manchester ,,	2 4	Newcastle ,, ,,	1 9
Leicester ,,	2 4	Sheffield ,, ,,	1 4½
Carlisle ,,	2 3	Plymouth (far from coalfields)	1 9
Oldham ,,	2s. to 2 3	Portsea ,, ,,	2 4
Salford ,,	1s. 11d. to 2 3	Rochester ,, ,,	2 9
Bradford ,,	2 1	Brighton ,, ,,	2 10
	s. d. s. d.		s. d. s. d.
Barmen	(2 6½) .. 4 6½	Aix-la-Chapelle	(3 4½) .. 3 11½
Schöneberg	(3 7½) .. 3 7½		
Lübeck	(3 4½) .. 4 7	Augsburg	(3 9½) .. 5 11
Görlitz	(3 4½) .. 4 9½		
Mayence	(3 4½) .. 5 1½		
Elberfeld	(2 10)* .. 3 6½	Dortmund	(2 10) .. 3 9½
Carlsruhe	(3 4½) .. 3 11½	Erfurt	(3 4½) .. 5 1½
Darmstadt	(3 11½) .. 3 11½		
Liegnitz	(3 10½) .. 4 4½	Frankfort-on-the-Oder	(3 10½) .. 4 6½
Zwickau	(3 4½) .. 4 5	Potsdam	(3 4½) .. 3 9½
Dantzig	(3 4½) .. 4 9½	Kiel (Gaarden)	(3 10½) .. 5 1½
Mannheim	(3 4½) .. 4 6½		
Halle	(2 10) .. 4 2½	Strassburg	(3 4½) .. 4 6½
Rixdorf	(2 10) .. 4 6½		

* Including one burner for lighting.

Herr Schiff points out that, taking the price of gas for power and heating purposes into consideration as well as the price for lighting, there is only one privately-owned gas-works—viz., Potsdam—in the list which he gives which supplies gas at a lower price than the municipal gas-works of about the same size with which each is compared. Consequently, he considers that Lord Avebury's view, that gas-works owned by companies generally supply gas at a lower price than similarly situated works owned by corporations, is broadly incorrect in so far as Germany is concerned. He then proceeds to refer to the profits claimed on behalf of a number of the municipal gas undertakings of Germany of which the gross profits for a few of the more important cities for the year 1905-6 are as follows: Berlin, £534,300; Hamburg, £250,000; Breslau, £171,600; Dresden, £127,450; Cologne, £112,750; Charlottenburg, £112,750. He then passes on to refer to the electricity works in Germany of which a larger proportion—viz., about one-third of the total—remain in the hands of companies.

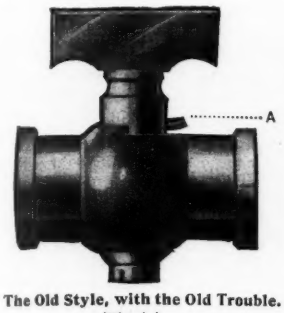
One important point which does not appear to have been dealt with by Herr Schiff, however, is that, in the majority of cases where a gas undertaking on the Continent is owned by a company, a large sum is paid by the company to the municipality for the right to supply gas in its district. These sums, whether they comprise an annual fixed payment for a term of years, or payment

* See "JOURNAL," Vol. XCVII., p. 22.

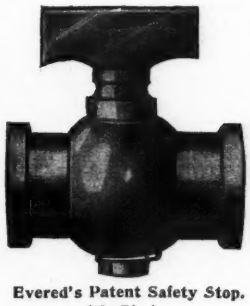
of a lump sum when the concession is granted or the contract settled, or of a percentage of the gross receipts of the undertaking, or a fixed sum per cubic metre of gas sold, constitute in reality the equivalent of the so-called profits on the working of a municipal gas-works. Whenever the concession to a company involves the payment of any such sums to the municipality or the State, it is evident that the prices charged for the gas by the company must be such that this "profit" for the municipality may be earned by the gas-works. Hence, unless the amount of such payments by the gas company to the municipality or State is stated and allowed for, it is impossible to institute a fair comparison of the prices charged for gas by municipal and privately-owned gas-works where such an arrangement obtains in regard to the latter. Consequently, Herr Schiff's interesting figures are not so informative as to the real advantages of the municipal ownership of gas undertakings as they might be, though doubtless they will be widely quoted by those interested in furthering municipal trading.

EVERED'S PATENT "SAFETY-STOP" TAP.

One of those small improvements that bring in their train considerable advantage has been made in gas-taps. The little stop-pin of common use in such taps has a large responsibility resting upon it. At the best, however, it can only be said to have performed its service with indifferent success, through the ever-present liability to becoming bent or broken, or dropping out, and thus allowing the tap, when the gas-light is being extinguished, to be over-turned, and thus produce the danger of an escape of gas. There is no saying what an amount of mischief has been caused by the defective or missing stops of the pin type. But absolutely permanent safety has now been ensured by the new "safety stop" which Messrs. Evered and Co., Limited, recently patented. The improvement consists in fitting a patent washer with a lug, which works in a recess in the body of the tap, and this recess rigidly defines the limit to which the tap can be turned. The lug is flush with the washer, and not above it; and there is nothing that can possibly wear away, nor is there any scope for damage, in the way of displacement or breakage. The illustrations are sufficiently explanatory. The patent safety-stop is at present only being applied to fittings when specifically ordered. As, however, the firm's present stocks of fittings are replaced, the new patent stop-taps will be applied; so that in time all their fittings will be supplied with it. Safety in a gas-tap is an important thing to secure.



The Old Style, with the Old Trouble. (Pin A.)



Evered's Patent Safety Stop. (No Pin.)

Underside, showing "Safety Stop" B, in Lieu of Pin.

A DOUBLE-COIN SLOT-METER.

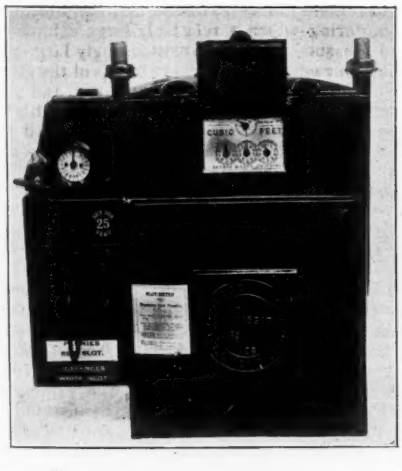
Mr. George Wilson's Patent.

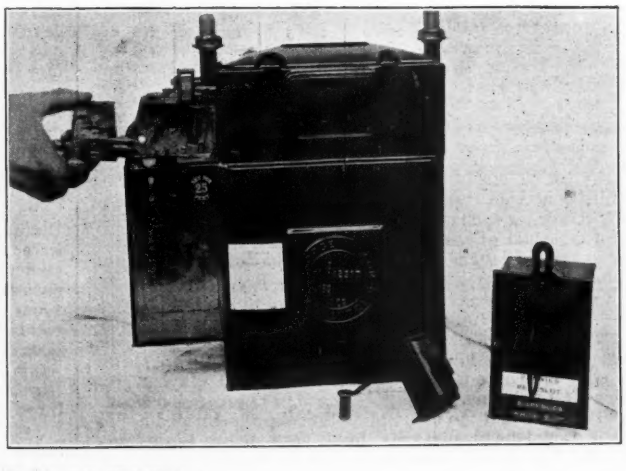
The prepayment gas-meter attachment of Mr. George Wilson, of Coventry, is, of course, very well known in the gas industry, and has secured its full share of favour; the special features of it being the simplicity and strength of the working parts, and the free access of the coin, which permits of a badly bent penny being inserted without choking of the mechanism or stoppage in working. The strong shut-off valve is part of the outside attachment, and (like the attachment-cover and case) is of special non-corrosive white metal, not liable, like cast iron, to fracture, or to damage like tinplate.

Until recently the mechanism referred to has been for single coins only; but a demand has recently sprung up for a double-coin attachment, and the Wilson slot-meter lends itself readily to such adaptation. To meet this demand, therefore, Mr. Wilson has devised a double-coin mechanism which, though it has been only a short time on the market, has been received with much favour, and has been adopted in a number of works. The invention is the subject of a patent which was abstracted and illustrated in the issue of the "Journal" for Aug. 17 last (p. 457).

The double slot may be for 1s. and 6d., 1s. and 1d., or 6d. and 1d.; the latter being generally preferred. The usual T handle is employed; the smaller slot being immediately behind the grip. Taking the 6d. and 1d. double-slot as an example, the action is simplicity itself. The money-dial takes from one to eighteen pence, which may be paid in either or both coins. The travel is the same for a penny or a sixpence; but in the latter case the handle, on being turned after inserting the coin, gives six distinct "clicks" before the coin falls into the money-box, while if by mistake the sixpence be put into the penny slot, it drops outside the attachment into a receiver, without actuating the mechanism, and the consumer can use the coin again. If, however, a sixpence and a penny be placed at one time one in each slot, the attachment does not fail to act; but in that case only sixpenny worth of gas is paid for, though both coins drop into the box. If anything over thirteen pence worth of gas is indicated as "paid for," no consumer is likely at that stage to insert sixpence; but, if he does so, all that happens is that fewer clicks will follow—the sixpence being held in suspense until some gas has been burned, when one or more click will send the coin home.

If for any reason it is desired to use one coin only, either slot can be permanently closed up. The change-wheel is fixed on a strong bracket, and can be altered at any time by the removal of a single screw. The attachment-cover is easily removable for price changing.





Wilson's Double-Coin Slot-Meter

The South Metropolitan Gas Company have placed a further order with Sir William Arrol and Co., Limited, for two Arrol-Foulis patent hydraulic charging-machines and two Hunter-Barnett patent hydraulic coke-pushers for their East Greenwich station. This makes a total of twenty-two of these high-capacity machines, some particulars of which were given in the "Journal" for the 12th of October last (p. 120), ordered by the Company during this year.

TECHNICAL GAS CALORIMETRY.

By J. H. Coste, F.I.C.

[From a Paper read before the Society of Chemical Industry.*]

When a fuel containing unoxidized or partially oxidized carbon and hydrogen, in any form, is burnt under suitable conditions, the carbon is burnt to carbon dioxide and the hydrogen to water. It depends on the conditions under which combustion takes place whether or not the water vapour formed is condensed. If it is condensed, the latent heat of vaporization of the whole of the water formed is included in the heating value of the fuel. When this happens, the calorific value thus obtained is called the "gross" calorific value. It is only in such appliances as geysers that the heat given out from the water vapour in this way is utilized. In most cases the "net" calorific power—*i.e.*, the heat evolved by combustion when all the water is kept in the form of vapour—is all that can he utilized in heating appliances. The difference gross and net calorific power is, therefore, a measure of the total amount of hydrogen present in a fuel.

It is obviously convenient to state the calorific power of gases in units of heat per unit volume. On the Continent, the cubic metre is usually employed in conjunction with the (great) calorie. In this country, illuminating gas is bought and sold, under various Acts governing the gas industry, by the cubic foot; and all the results of statutory testings are corrected to a cubic foot at 60° Fahr., and 30 inches barometer. The official testings of illuminating gas in the Metropolis are returned in calories per cubic foot; and the only parliamentary standard for the calorific power of illuminating gas is expressed in this manner. In all figures given in this paper, the calorific power is expressed according to this official usage. The number of calories multiplied by 3·968 gives British thermal units.

I.—Calorimetry.

Any calorimetric method should give a means of determining, with such accuracy as may be possible, both gross and net calorific power. This object may be attained by either an indirect or a direct method.

The Indirect Method of Determining Calorific Power.—The researches of Julius Thomsen and of Berthelot have placed at our disposal values for the heat of combustion of hydrocarbons and other combustible gases and vapours which are sufficiently reliable for most purposes. By means of these, it is possible, if the composition of a gaseous mixture is known, to calculate its total calorific power.

In the case of coal gas and similar mixtures, a difficulty arises in connection with the unsaturated hydrocarbons. It is difficult, and in most cases impossible, to decide their actual nature; and as the various hydrocarbons which may enter into their constitution have very different calorific values, the matter is of importance, as will be seen from the following table (calculated from Julius Thomsen's figures) giving the calorific values in great calories per cubic foot of various gases (A) measured at 0° C. and 760 mm., and (B) at 15·5° C. (60° Fahr.) and 762 mm. (= 30 in.); the products in each case being cooled to 18° C.

—	(A)		(B)	
	Gross.	Net.	Gross.	Net.
Methane	268·0	240·5	254·3	228·2
Ethane	468·0	427·0	444·0	405·2
Ethylene	421·0	394·0	399·5	373·0
Propylene	622·0	581·0	590·2	551·3
Acetylene	392·0	378·0	371·9	358·7
Benzene	1010·0	969·0	958·3	919·4
Hydrogen	86·4	72·8	82·0	69·1
Carbon monoxide	85·9	85·9	81·5	81·5

It will be noticed that the difference between gross and net calorific power for each molecule of water formed by the combustion of a molecule of gas is in (A) 14 calories, in (B) 13 calories per cubic foot. In other words, the difference between gross and net calorific power multiplied by $\frac{100}{14}$ or by $\frac{100}{13}$, as the case may be, will give the total percentage of hydrogen in the gas.

A gas, the calorific power of which had been found by direct means to be 150·3 calories gross and 133·2 calories net, was found to have the composition indicated in the next table. The unsaturated hydrocarbons were assumed to be (1) ethylene, (2) propylene, (3) butylene.

It will be seen that the assumption that the unsaturated hydrocarbon is propylene gives results closely approaching those found experimentally. It is, in fact, found to be a good working convention for general purposes that the average calorific value of the unsaturated hydrocarbons is equal to that of propylene. The following table serves to illustrate the agreement between results calculated in this way and those obtained directly:—

Composition.	Calorific Power (Calculated).			
		(1) Gross.	(2) Gross.	(3) Gross.
Carbon dioxide	nil	..	..	..
Oxygen	0·27	..	..	..
Unsaturated hydrocarbons	5·38	21·52	31·74	41·96
Carbon monoxide	13·09	10·73	10·73	10·73
Hydrogen	42·45	34·85	34·85	34·85
Methane	27·71	70·43	70·43	70·43
Nitrogen	11·10	..	..	..
	100·00	137·53 cal.	147·75 cal.	157·97 cal.
Per cent. total hydrogen	..	108·63	114·01	119·39
Deduction for latent heat	..	14·10 cal.	14·82 cal.	15·51 cal.
Net calorific power	..	123·43 ,,	132·95 ,,	142·46 ,,

Experimental.		Calculated.	
Gross.	Net.	Gross.	Net.
166·6*	149·3	167·4	150·0
150·3	133·2	148·2	132·8
143·0	127·7	143·2	128·2
148·0	130·3	143·5	128·5
143·5	127·9	143·6	128·6
145·7	129·3	143·9	128·8
145·8	131·0	147·3	131·8
143·3	128·3	144·7	129·2
143·1	126·2	140·0	125·6
152·6	134·2	152·3	134·9
143·5*	127·7	142·5	128·5
145·7*	129·3	143·8	128·3
144·5*	129·5	146·3	130·5

* Pure coal gas.

Direct Methods of Determining Calorific Power.—Various forms of calorimeter have been devised for determining the calorific power of gases. They all depend on a known amount of water being heated to a measured extent by a known volume of gas. Two principal types of calorimeter have been proposed—(*a*) those in which a small, and usually a fixed, amount of gas is allowed to burn out and to heat a small and fixed amount of still water; (*b*) those in which gas burnt at a measured rate is allowed to heat to an observed temperature a constant stream of water, a definite amount of which is collected during the period of observation. In the former class, the highest temperature of a rise—transient equilibrium—is noted; and in the latter the temperature which is reached as the result of a continuous equilibrium. The flow calorimeters are to all intents "geysers" in which special care is taken to ensure complete combustion of the gas and complete absorption of the heat evolved. In either case, it is obviously desirable that the proportions of gas burnt and water heated should be so adjusted that the rise of temperature may always be sufficiently great to ensure reasonable sensitiveness of reading, and not high enough to render loss by radiation a serious consideration. This optimum range of rise will vary in different instruments according to the efficiency of the measures taken to prevent radiation.

For the determination of the calorific value of a gas supply of any kind which can be burnt in practically unlimited quantities, no doubt the flow type of calorimeter is better, as the apparatus can be adjusted to remain in a state of thermal equilibrium for a considerable time, during which a relatively large volume of gas can be burnt and measured, and a correspondingly large volume of water heated and measured. Several readings of the temperature of the water at the inlet and outlet can be taken, and average temperatures computed for both the inlet and outlet with a high degree of accuracy. The amount of water condensed in the abstraction of heat from the products of combustion can also be arranged to be sufficiently great to secure a good determination of net calorific power.

On the other hand, the classical work of both Thomsen and Berthelot was carried out in calorimeters of the burn-out and fixed water type,* and for technical purposes both Hempel's and Simmance and Abady's portable calorimeters, which are of this type, give, if carefully adjusted and used, results of a fair degree of accuracy. Only the gross calorific power is determined in the two latter instruments. Calorimeters of the still-water type have been devised by Berthelot (bomb), Thomsen, Fischer, Hempel, and Simmance and Abady; and of the flow type by Hartley, Junkers, Boys, and others. [The author summarized the principal features of some of the more important of these instruments.]

Sources of Error Affecting the Results Obtained from Flow Calorimeters.—The following sources of error, for the effects of which due allowance may be made, are likely to affect the results of calorimeters of the Junkers or Boys type. (1) Heat lost or gained in the exit gases according as they are hotter or cooler than the inlet air. (2) Heat lost or gained by condensation or evaporation of water during the passage of the air through the calorimeter.

* An abstract of the paper, which was read at the meeting of the London Section of the Society on the 1st ult., was given in the "Journal" for the 9th ult. (p. 407), with a report of the discussion upon it. The full text of the paper appears in the current number of the Society's "Journal," from which it is reproduced.—Ed. J.G.L.

* The difficulty of preparing large quantities of pure gases no doubt helped to determine this choice.—J. H. C.

(3) Losses by radiation from body of calorimeter. (4) Errors due to assumption that a litre of water weighs one kilogramme. The values of these errors and the proper assignment of corrections to gross or net calorific power have been worked out in the case of the Boys instrument.

(1) The volume of exit gas compared with that of gas burnt has been determined by analysis of both the gases. [See table] The heat capacity of the products from 1 cubic foot of gas, on the assumption that 7 cubic feet are obtained, is about 0·06 cal. Experiments under varying conditions have led Boys to adopt the empirical correction of 1/6 cal. for a difference of 1° between the inlet and outlet air, indicating that other influences are included in this correction which under any conditions is small.

—	I.	II.
Rate of burning, feet per hour	4·6	4·6
Carbon dioxide formed on explosion of gas, per cent.	56·0	57·1
Composition of exit gas—		
Carbon dioxide	8·76	8·52
Oxygen	6·17	4·47
Ratio—gas : air	1 : 6·9	1 : 7·2
gas : exit gases	1 : 6·4	1 : 6·7

(2) If the temperature of the exit gases is above the dew-point of the atmosphere of the laboratory, the exit gases, which are fully saturated, will rob the system of an amount of heat equal to the latent heat of vaporization of the additional water contained in them; and, further, the amount of condensed water will be reduced to a corresponding extent. On the other hand, if the exit gases are cooler than the temperature at which dew is deposited in the laboratory, the calorimeter will gain an amount of heat and of water corresponding to the reduced water-holding capacity of the air.

The extreme magnitude of this error can be illustrated by an example. Suppose the temperature of the laboratory to be 21° C. and the air fully saturated with aqueous vapour, the temperature of the water supply being low, and the exit gases having a temperature of only 10° C. If during the burning of 1 cubic foot 7 cubic feet of these gases pass through the instrument, corresponding to 7½ cubic feet of air entering, the total amount of water vapour entering will be 4·3 grammes (0·5 in gas, + 3·8 in air). The total amount of water leaving will be 1·8 grammes, and the excess water condensed (4·3 − 1·8) = 2·5 grammes.

The Junkers and Boys calorimeters may be considered as the two most in use for practical purposes; and it may be well to discuss at length their respective advantages and disadvantages, and the necessity for applying certain corrections to the results obtained with them.

Although both instruments are fairly portable, the Junkers certainly has the advantage in this respect. Its simplicity and the fixed arrangement for obtaining a proper head of water render it particularly suitable for fitting up in any locality. The flow of water can be easily regulated by means of the quadrant tap; and for gases of very varying calorific power, the use of a bunsen flame enables perfect combustion to be attained at any reasonable rate of consumption. The rise of temperature attained by the exit water can be kept constant by altering the amount of water passing through the instrument. The Boys instrument is easier to read, owing to both thermometers being on the same level. It is more sensitive to rough handling. The temperature of the exit water is more constant in the Boys than in the Junkers instrument.

The agreement of the results (calorific power) obtained by the simultaneous working of two Boys calorimeters with the same gas is shown below:—

—	No. 1.		No. 26.	
	Gross.	Net.	Gross.	Net.
I.	146·0	129·4	146·0	129·5
II.	145·8	129·0	145·0	129·2
III.	146·7	126·9	147·0	128·5
IV.	147·9	130 9	145·9	129·9
V.	146·1	129·0	146·3	129·9
VI.	146·8	130·1	145·8*	130·2

* Gas burning at 2½ cubic feet per hour; all others at 4 to 5 feet.

A similar series has been carried out with the Boys and Junkers instruments.

—	Boys No. 26.		Junkers.	
	Gross.	Net.	Gross.	Net.
I.	144·9	130·1	145·8	130·8
II.	145·1	130·2	146·1	131·4
III.	147·3	132·9	146·7	132·0
IV.	145·9	131·0	144·4	130·9
V.	144·6	130·6	145·0	130·2
VI.	143·8	129·3	144·7	130·1
VII.	143·9	129·8	144·6	129·8
Average	145·1	130·6	145·3	130·7

The behaviour of both instruments with gas burning at different rates, the water flow being maintained at a constant rate, is satisfactory, as shown in the following series of experiments:—

Consumption of Gas per Hour.	Boys.		Junkers.	
Cub. Ft.	Gross.	Net.	Gross.	Net.
5	146·3	130·9	146·0	131·6
4	145·1	130·1	145·1	130·8
3	146·5	130·4	—	—
2	144·2	128·7	146·8	131·9

It has been suggested that combustion is not perfect in the Boys instrument, owing to the use of flat-flame instead of atmospheric burners. To test this point, a tube was inserted in one of the holes in the top of the calorimeter, and the exit gases slowly aspirated (1) over pumice saturated with caustic potash solution, (2) sulphuric acid, (3) a weighed soda-lime tube, (4) a column of about 12 inches of heated copper oxide, (5) a weighed sulphuric acid tube, and (6) a weighed soda-lime tube. Eight litres of carbon dioxide free products, corresponding to nearly 9 litres of exit gases, were first collected. Tubes (3) and (6) had not altered in weight, and tube (5) had gained 0·008 gramme (= 0·0009 gramme hydrogen). Any unburnt carbon should have been oxidized by the copper oxide and weighed as carbon dioxide in (6). The gas (ordinary house gas, having a gross calorific power of 147 calories, was used for the experiment) was burning in the calorimeter at the rate of 5·3 cubic feet per hour—that is, above the maximum rate allowed in official testings. The error due to imperfect combustion is therefore negligible.

Both instruments may be expected to give the best results when working under the conditions which should prevail in a physical laboratory, and both give very good results under conditions much less satisfactory.

II.—Calorific Power of Gas Considered in Relation to Methods of Manufacture and to Illuminating Power.

The calorific power of gas depends—as undoubtedly does the illuminating power—on its composition. The relation between calorific power and composition is, however, much more direct than in the case of illuminating power. It is, as has been shown, easy to calculate with considerable accuracy the calorific power from the results of analysis of a gas. In the case of illuminating power, it is at present impossible. A consideration of the calorific power of the three principal constituents of coal gas—carbon monoxide, 81·5 gross 81·5 net; hydrogen, 82 gross 69·1 net; methane, 254·3 gross 228·2 net—indicates very clearly that a gas which has been made under conditions favouring the formation or survival of a large proportion of methane should have a higher calorific power than one where the temperature of carbonization tends to the production of a large amount of hydrogen, and the use of an exhaust leads to the formation of large quantities of carbon monoxide. Blue water gas lowers the calorific power of coal gas with which it is mixed, for similar reasons. The effect of the addition of carburetted water gas varies according to its composition. Its general effect is to lower the calorific power, or at any rate not to increase it even in cases where its use has the effect of increasing the illuminating power. In the case of a pure coal gas, more than half of the net calorific power appears to be due to the methane; whereas in mixed gases the methane seldom accounts for more than 46 per cent.—the usually somewhat increased amount of unsaturated hydrocarbons more or less making up the deficit due to the lower proportion of methane.

It was formerly believed that some direct relationship between calorific and illuminating power existed; but an examination of thousands of tests shows that, though the general tendency is for gas of a high illuminating power to have a relatively high calorific power, such numerous exceptions and anomalies are observed, even with pure coal gas, that no formula usefully connecting these two properties can be found.

The following table shows what a wide divergence occurs between observed calorific power and the figure obtained by multiplying individual results of illuminating power by the average number of calories per candle. The results at five places supplied with pure coal gas were examined; and the figures represent averages of daily testings for two succeeding months.

—	Average. (A) Illuminating Power.	(B) Gross Calorific Power.	(C) Calories Per Candle. $\frac{B}{A}$	Greatest Difference between Observed Calorific Power and Product of Observed Illuminating Power and the Figure in Column (C).	
				Calories.	Per Cent.
I.	16·88	151·0	8·95	8·9	5·9
	16·97	151·3	8·67	14·4	9·5
II.	17·11	150·6	8·87	10·1	7·2
	17·03	150·2	8·85	9·7	6·4
III.	16·77	146·4	8·83	4·5	3·1
	17·07	146·7	8·60	9·8	6·7
IV.	15·75	151·6	9·62	5·2	3·5
	16·01	152·7	9·57	6·7	4·4
V.	16·36	148·3	9·04	8·4	5·8
	17·17	150·4	8·76	5·2	3·4

Although the average ratio from month to month agrees fairly, showing that considerable regularity of manufacture is attained, it is clearly impossible to assign to gas of known candle power a definite calorific power on mere *à priori* grounds. Standards can only be fixed as the result of careful examination of long series of results; and no means have been devised for determining the calorific power of a gas except by analysis or calorimetry. It can be safely stated that, for the same candle power, pure coal gas will in most cases have a somewhat higher calorific power than mixed gas.

This will be, perhaps, more apparent in the case of low-grade gas. The average calorific power of coal gas of from 14 to 15 candles illuminating power is about 130 calories net, while mixed gas of the same illuminating power has an average calorific power (net) of about 125 calories; 16-candle coal gas, on the other hand, has an average calorific power of not more than 2 or 3 calories above 16-candle mixed gas.

The difference between gross and net calorific power is greater as the calorific power increases. An examination of three sets of results—two (A and C) mixed gas of 16 and 14 candles nominal illuminating power respectively, and the other (B) pure coal gas—shows that the difference is proportionately greater in the case of coal gas than for mixed gases. These figures agree with the results for total hydrogen in the gas, deduced from analysis. As to the actual differences between gross and net calorific power, it appears unlikely that this should ever exceed 20 calories in the richest coal gas, or fall below 12 calories in the poorest mixed gas now supplied.

Difference between Gross and Net Calorific Power expressed as Percentage of Gross.

Periods of Four Weeks (Daily Testings).	(A)	(B)	(C)
I.	10·64	11·25	10·92
II.	10·80	11·46	10·87
Averages	10·72	11·35	10·90

In the following table, the composition, calorific power, and illuminating power of (A) coal gas made in small works using clay retorts but no exhauster, (B) coal gas supplied by one of the Metropolitan Companies, (C) mixed gas supplied in the Metropolis, and (D) gas from Glover-West vertical retorts analyzed by Dr. H. G. Colman, are shown. The calculated calorific power for (D) was 142·6 gross and 126·9 net. It will be noticed that though the 21-candle gas (A) shows a marked superiority in heating value, the nominal 14 to 16 candle gases do not, with one exception, which in composition closely approaches the 21-candle gas, differ greatly in calorific power among themselves.

—	(A)			(B)			
Carbon dioxide	0·38	nil	nil	1·48	1·75	2·11	2·85
Oxygen	nil	nil	nil	0·26	0·52	1·05	0·20
Unsat. hydrocarb.	6·17	5·57	6·00	3·39	4·73	2·98	3·60
Carbon monoxide	4·86	6·03	9·24	8·17	7·18	10·00	7·43
Hydrogen	41·72	39·83	40·00	49·21	40·50	48·41	46·66
Methane	40·67	41·78	40·48	31·22	39·50	30·80	31 54
Nitrogen	6·20	6·79	4·28	6·27	5·82	4·65	7·66
Calorific power—							
Gross	175·8	179·6	176·0	144·5	166·6	145·7	143·4
Net	160·5	161·4	157·5	129·5	149·3	129·3	128·9
Illuminating power by "Metropolitan" argand No. 2 at 5 cubic feet per hour	21·39	21·77	21·10	18·60	18·21	14·48	14·65

—	(C)						(D)
Carbon dioxide	1·45	1·74	2·13	5·00	1·51	3·83	1·00
Oxygen	0·73	0·37	0·28	nil	0·53	0·29	0·05
Unsat. hydrocarb.	4·91	4·59	5·39	5·50	5·07	5·45	2·85
Carbon monoxide	14·46	13·22	16·15	16·00	13·31	15·02	8·70
Hydrogen	46·73	50·76	39·24	39·30	43·62	42·10	54·70
Methane	24·57	26·08	24·79	24·00	26·17	23·45	29·05
Nitrogen	7·15	3·24	12·02	10·20	9·79	9·86	3·20
							99·55
Calorific power—							
Gross	144·8	145·1	145·2	141·4	143·5	143·2	144·3
Net	129·2	129·1	128·5	124·5	127·9	126·3	129·6
Illuminating power by "Metropolitan" argand No. 2 at 5 cubic feet per hour	16·65	16·58	16·21	15·80	17·29	16·81	15·56

In conclusion, it is most desirable that gas authorities should follow the example which has recently been set in the Metropolis by instituting regular testings for calorific power, in order that a standard which will meet local conditions may be fairly settled when a suitable occasion arises.

CHARGING MACHINE FOR SMALL WORKS.

At the gas-works of Udine, in North Italy, a manual machine on the system of Carl Francke, of Bremen, has been adopted for charging the horizontal retorts. The system was described in a recent number of "Il Gaz."

In the article referred to, it is pointed out that in large gas-works, economy in labour and reduction of staff may be effected, and may be due, not only to the adoption of mechanical means of charging and drawing retorts, but rather to the building of new types of settings. In small works, on the other hand, where practically all the retorts are of the horizontal kind, the reduction of labour is able to be effected only by the adoption of some machine for the service of the retorts. Many such machines have been installed in small works in recent years for the purpose of facilitating the onerous work of the stokers.

The particular machine referred to above was designed with a view both of reducing carbonizing costs and at the same time of securing a larger make of gas from the same number of retorts. It consists of a charging scoop divided into two parts, the back or guiding head of which is hung on the vertical pillars of a crane which travels on two wheels in front of the retort-bench. The overhead cross beams of the crane run on rails fixed on the walls of the house and along the face of the ascension pipes. The crane-pillar enables the scoop to be swung either to the right or the left as may be desired for filling the scoop with coal from the adjacent store. The special advantage claimed for this scoop is

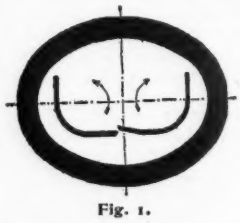


Fig. 1.

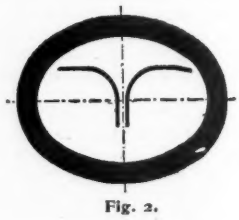


Fig. 2.

that the two parts of it turn from the centre outwardly, as indicated in figs. 1 and 2, with the result that the charge of coal falls uniformly on to the opposite sides of the retort, as shown in fig. 3. No further levelling of the charge is required; and no other rake for such purpose is necessary. The yield of a retort-bed thus charged is said to be greater than if charged ordinarily by hand, as the regular layer of the coal facilitates, as is well known, the make of gas. If the two parts of the scoop were made to turn from outwards to the centre, the heap of coal would fall as appears in fig. 4, when a rake would be required to level or spread out the charge.

Fig. 3.

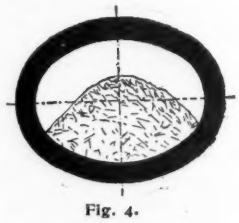


Fig. 4.

The Francke scoop is of a large pattern and is U-shaped, one section of which slightly overlaps the other. It is stoutly made of sheet steel, without any supplementary strengthening bars, which have the disadvantage, when such a scoop is withdrawn, of bringing out with them pieces of coal. One divided scoop is better than two separate ones, as with the latter (as can be seen in fig. 5) there is an unutilized space at the bottom in between them.

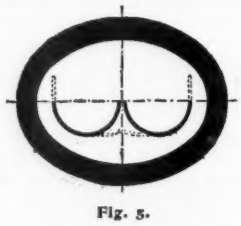


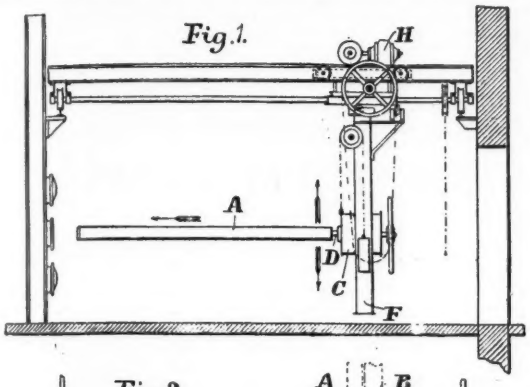
Fig. 5.

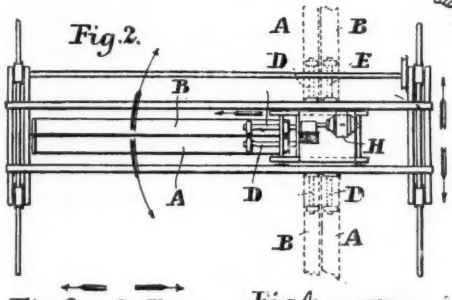
With the Francke scoop described, a 3-metre (10-feet) retort can be conveniently charged with 200 kilos.—say, 4 cwt.—of coal; the resulting coke being also of greater value by reason of the better gasification of the coal.

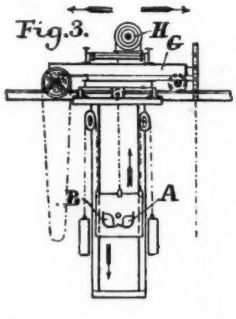
One man is enough to work the apparatus; and the time taken for the complete charging of a retort is about 20 seconds. The working of it is of the lightest character, and the wear of the moving parts is guarded against. It can be worked electrically; but this is hardly necessary. It is said that good results have been obtained with the machine at Udine and several other places where it has been adopted.

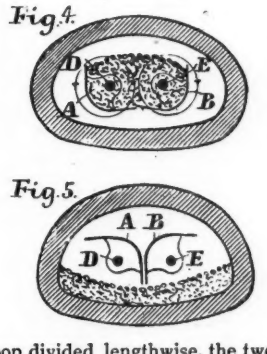
DUNKEL'S RETORT-CHARGING SYSTEM.

A French patent has been taken out by M. Richard Dunkel for a machine for charging gas-retorts by means of a scoop of semicircular or similar shape. The object of the inventor is to render unnecessary the spreading of the coal in the retort, and by this means to reduce the time required for charging, prevent loss of heat, and allow of heavy charges being employed. The arrangement is shown in the accompanying illustrations, in which fig. 1 is an elevation, fig. 2 a plan, and fig. 3 a side view; figs. 4 and 5 being sections of a retort showing a scoop in two positions.









The appliance consists of a scoop divided lengthwise, the two halves of which A B turn outwards when the scoop opens; the middle edges rising first. The coal is thus thrown from the scoop so as to glide downwards on each side of the retort, and consequently cover a wide area. It is claimed that the appliance is favourable to a large production of gas, and that the coke obtained is of good quality. Moreover, the way in which the coal is emptied into the retort leaves sufficient room in the centre of the heap to introduce the rake, so that the coke can be easily drawn. The machine is so constructed that the scoop is secured to a head C by means of two shafts D E, which rotate at different rates of speed, so that one half of the scoop is a little in advance of the other. This is necessary in order that the two halves may be able to pass each other.

The scoop can be brought to any position in front of the setting; and to allow of this being done, it is so arranged that it can ascend and descend in a frame F, which turns on a truck G. The latter moves in the direction of the axes of the retorts on a travelling crane running along the front of the setting. In order that the scoop may be raised and lowered more easily, the machine can be furnished with counterweights. Electric motors can be utilized to work the plant. The raising and lowering of the entire scoop, as well as its introduction into the retorts and movement of the crane, can be done with the electric motor. With through retorts, the machine can be arranged so as to be simultaneously utilized to remove the coke. The scoop is then provided with plates on its end, which push the coke out on the side opposite to that on which the charging is done.

At St. George's Church, Gateshead, on the 11th inst., the marriage was solemnized of Mr. Herbert Gillies Penney, second son of Mr. and Mrs. J. H. Penney, of South Shields, and Miss Lottie Affleck, only daughter of Alderman Robert Affleck, J.P., and Mrs. Affleck, of "Bloomfield," Gateshead.

DEPTH OF LAYING WATER-PIPES.

At the Annual Meeting of the New England Water-Works Association last year, a Committee was appointed to collect statistics in regard to the depth at which water-pipes are laid, and the resulting experience in freezing. The report of the Committee was presented for discussion at the recent meeting of the Association; and the following extracts from it are taken from "Engineering Record."

The Committee received 90 replies to a circular-letter, 320 copies of which were sent to water-works engineers in the United States and Canada. An average of the replies received indicates that freezing extends 1 foot deeper in streets than in fields; also that in streets frost will reach 1 ft. 5 in. deeper in gravel than in clay, with sand half-way between. In fields it would appear that frost will extend 1 foot farther in gravel than in clay, with sand again intermediate in effect. It is obvious that the character of the soil is a factor of such relative importance as to demand consideration in determining the economical depth.

There were 53 places which reported actual experience in the freezing of pipes. All these cases were in distribution systems—none in the leading mains. Fifty per cent. were on dead-ends; and all were in pipes where there was little or no velocity. All but three of the cases of freezing were in pipes smaller than 10 inches diameter; and only seven in pipes as large as 8 inches. In all cases the ground was frozen below the axis of the pipe; and the ground water level was also below the pipe. In 80 per cent. of the cases the ground was bare of snow at the time of freezing. All the stoppages were total. There were 35 places which reported the character of the soil in which the pipes were laid; and of these, 40 per cent. were in clay, 48·6 per cent. in gravel, 5·7 per cent. in sand, and 5·7 per cent. in rock.

The data upon the depth of pipe beneath the ground surface are presented in the report in the form of a diagram. The variation in the relation of depth to temperature of the coldest month is due in some cases, according to the report, to local conditions, and in others, perhaps, to an illogical adaptation of depth to the requirements. In two cities having practically the same mean temperature for the coldest month, the depth of pipe was 3 ft. 6 in. in one case and 6 ft. 6 in. in the other. Obviously, the local conditions other than temperature, and including depth of snow covering, must furnish, in great part, the explanation. The lesser depths employed in the places which appear below the average line in the diagram are not explained by the use of ground water supplies, as there are as many of these above the average line as there are below. Users of shallow depths report practically no trouble; and the question remains whether this immunity results from peculiar local conditions or whether the general practice is unduly conservative. It would seem that, where there is any velocity of current, depths somewhat less than those indicated by the average line generally prove sufficient to prevent freezing.

While all cases of freezing reported are stated to have resulted in total stoppage of the pipes, there are records of ice formation in concentric rings in pipes as large as 24 inches diameter; the occurrences not being evidenced by stoppage of the large main, but only by loss of head through increased friction, or, in some cases, by stoppage of gates or smaller pipe connections by the ice loosening and breaking up in a thaw and forming an ice-jam at some point of obstruction. Such formation of lumps of ice in a layer adjoining the metal of the pipe has occurred in instances of extreme low temperature in the eastern Canadian Provinces in conduits where there was a considerable velocity. As the ring of ice forms, the velocity of the water increases, and a total stoppage does not result. In other cases of freezing, particularly in smaller pipes, the ice formation is not solid, nor does it start from the outside, but is rather in the form of "slush" uniformly distributed throughout the cross section of the pipe. This has been noted, the report states, in a 4-inch pipe, in which there was considerable velocity, laid at a depth of 6 feet in a salt marsh in New Brunswick.

When the velocity in a pipe exceeds about 3 inches per second, and particularly in the case of ground water supplies, it is stated that depths somewhat less than those now used would generally be safe. In main feeders, and in those portions of the distribution system where there will be an assured circulation, the question of minimum depths should receive careful consideration. It is not in the mains but in the services that most of the trouble from freezing occurs; and in the services such trouble usually results, according to the report, from skimping by plumbers or contractors, resulting in the actual laying of the services at depths considerably less than the mains.

There were 28 places which reported the tapping of service connections on the top of the main, 39 on the side, 12 on the quarter, and 7 in various ways. Freezing of services, it is stated, generally starts at the house and backs out into the main; and it is believed that if services were tapped on the side of the main, and then dropped to the depth required to meet local conditions, the lessening of the depth at which the main is laid to that justified by the velocity of the water in the main will not result in any increased freezing of services.

According to the report, there is a belief or tradition in the minds of many plumbers and water-works superintendents that most stoppages by ice formation occur in a thaw which follows a period of very severe cold weather; and the reason generally

advanced for this alleged phenomenon is that evaporation from the surface during the early stages of the thaw produces additional refrigeration or reduction of temperature at the depth of the water-main sufficient to cause freezing. No indication of the existence of such conditions has appeared in the reports received of frozen pipes.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The Annual Dinner of the Western District of the Scottish Junior Gas Association was held in Sloan's Café, in the Argyle Arcade, Glasgow, on Saturday evening. There was a good company, over which Mr. D. CURRIE, of Stirling, presided.

Mr. A. SMITH (Tradeston) proposed the toast of "The Scottish Junior Gas Association—Western District." He said that the Association was now five years old; and they would agree with him that much profit had come to the members through it. The papers and lectures, together with the discussions, had been most interesting, and no less instructive. Quite a feature of the work of the Association was the visits to gas and allied works, which gave them all an opportunity of becoming acquainted with the advancement and progress that was taking place in their industry. He was certain benefit would come to the members if they would attend the meetings, and endeavour as far as possible to take part in the discussions. He sometimes wondered whether it was the presence of the honorary members, or of the representatives of the Press—he thought it was the latter—which was the cause of so many members being backward. Might he suggest that these two classes of "bogey men" be excluded for one night, and let the members have the meeting to themselves. The result would be awaited with interest. If he might offer a word of advice to the juniors, it was that they should endeavour to read the technical journals carefully, for there they would find full accounts of what was taking place in the industry in which they were interested. They were all aware that a Gas Exhibition had been proposed for Glasgow. It had been postponed till next autumn; but he was sure that when it was held it would do good work for the city and the industry.

The PRESIDENT expressed thanks, on behalf of the Association, to Mr. Smith for his kind remarks and words of advice and encouragement. As an Association, they had reason to congratulate themselves on having so many eminent honorary members taking such an interest in their work; and they were also indebted to those honorary members who had shown such practical interest in their work as to provide medals for the best papers read. He desired to thank the managers of various undertakings for allowing them to inspect their works. On the subject of the members taking part in discussions, he thought they would be better prepared to discuss the papers if they had an opportunity of reading them previous to the meetings.

Mr. G. R. HISLOP (Paisley) proposed "Kindred Associations." He said that while they all believed in the general fulfilment of the Burns' prophecy that the time would come when "man to man the world o'er would brithers be an' a' that," he thought that the gas engineers of this country were entitled to the credit of giving the first example of the fulfilment of the grand idea of that prophecy, because they could all see with what heartiness they extended the right hand of fellowship to all their brethren in the gas industry. He could not well express the gratification which he had in reading the papers and discussions which they had from time to time. They were exceedingly creditable, and were most edifying, not only to the members themselves, but he thought that the gas companies and corporations could not shut their eyes to the fact that the papers and discussions must be of great financial value to them. He felt sure that gas had a sphere of usefulness to mankind which no other rival would ever extinguish. This was a great satisfaction to them. No doubt, it could not be denied that electric light had done a very great deal for gas. It had roused them up to the highest endeavour possible, to produce gas cheaper and more suitable for all the purposes of life. They were in the midst of new developments, and scarcely knew where they were to end; but it was for all of them to apply themselves diligently to the task of finding out what was best for each. No one thing would suit everyone alike. He asked them to join with him in expressing their best wishes for the success and prosperity of kindred Associations, which now, he understood, had reached their majority in number—21.

Mr. A WILSON (Glasgow) said he felt honoured in being asked to reply to a toast which had been so ably proposed by Mr. Hislop. The name of Hislop was one to conjure with in the gas world. It had a reputation second to none. They were honoured in having the toast proposed by one who was almost the father of the gas industry. Mr. Hislop had told him for 62 years he had been a Gas Manager. Mr. Hislop had spoken of the value of the Associations; and he, as Vice-President of the Institution of Gas Engineers, could heartily re-echo what he said on this point. Every one of the Associations ought to be an advertising medium for gas. They had the best article to sell, the most economical and the most efficient; and they should let the public know it. There was a great field for gas yet. There was, in Glasgow, an immense field unworked, in the matter of warming and cooking, and in the methods of heating water. It was most wonderful what revival was taking place in gas business through the Associations. There seemed to be a new spirit abroad—a desire to get the gas industry placed on a sure and certain foundation, so that it might the better fulfil its destiny.

Mr. D. VASS (Airdrie) presented the gold medal for the best paper read during last session, to Mr. G. H. M'Cowat, whose paper was entitled "Distribution of Gas and Main-Laying." The papers read before the Junior Associations were, he said, all of a very high standard; and they must remember that, while the presentation of the medal marked out what was considered to be the best paper, there were others which were so excellent that it was a matter of difficulty sometimes for those who were adjudicating upon them to arrive at a conclusion as to the best.

Mr. M'COWAT returned thanks.

During the evening, an excellent programme of music was gone through.

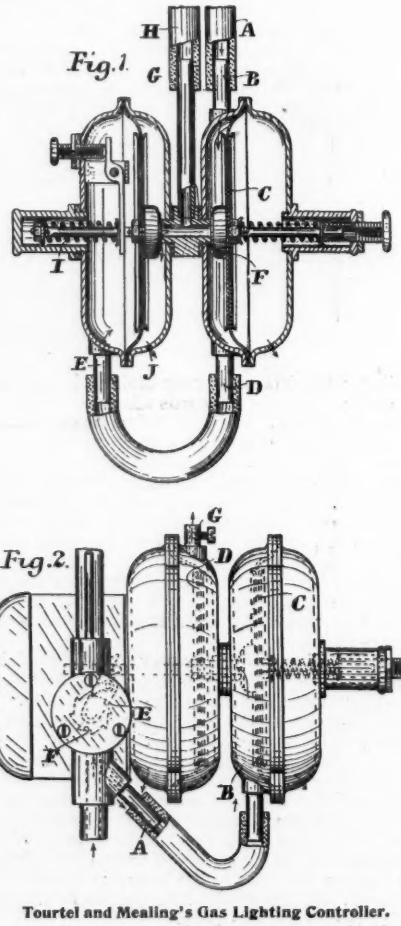
REGISTER OF PATENTS.

Controller for Gas Lighting and Extinguishing.

TOURTEL, J. M., of Chiswell Street, E.C., and MEALING, W. R., of Twickenham, S.W.

No. 24,849; Nov. 18, 1908.

This invention relates to apparatus for lighting and extinguishing gas-lamps from a distance by varying the pressure in the mains—particularly that class of apparatus in which a diaphragm or liquid sealed bell (provided with means for turning on and off the supply of gas to the burner) is connected to the gas supply and is subjected to substantially the full pressure of the gas when a predetermined maximum pressure is reached. The invention relates to the means of controlling the admission of gas to the diaphragm at the predetermined maximum pressure. For this purpose, the inventors employ a throttled passage (as described in patent No. 7197 of 1907), or else a valve or the like is arranged to effect the discharge at a predetermined minimum pressure (as described in patent No. 21,185 of 1908).



Tourtel and Mealing's Gas Lighting Controller.

Fig. 1 shows the invention working in conjunction with a discharge controlling diaphragm. Fig. 2 shows a form applied to a tap-operating diaphragm like that described in the first patent already referred to.

In fig. 1, the gas-supply pipe A is connected to the diaphragm case formed of two equal parts; the connection of the gas being through the inlet pipe B between the diaphragm C and the left side of the case.

An outlet pipe D is connected by the tube to the inlet pipe E attached to the outlet controlling valve case formed of two parts, with a diaphragm between. There is a constant pressure of gas from the pipe A; and the arrangement of the diaphragms and their parts is such that, when the gas is under a predetermined maximum pressure, the spring arranged round the rod of the diaphragm C is sufficiently strong to keep the valve F closely on to its seat, and thus close the passage of a connecting piece which is shown joining the two valve cases together, and from which connecting piece an outlet pipe G, leading to the tap-operating diaphragm or bell by the pipe, is connected. The pressure of gas conveyed through the pipes to the diaphragm in the left-hand case tends to press with its valve against the end of the passage in the connecting piece, and thus seal it. When the pressure of the gas falls below the power of the tension spring I, which is regulable by means of a pivoted lever and finger screw, the spring withdraws the diaphragm, with its valve, and opens the end of the passage.

Thus, while the gas is below the predetermined maximum pressure and greater than the predetermined minimum pressure, the valves will be held closely on to their seats and the inlet, and escape from the pipe G are sealed. Immediately, however, the gas rises to the maximum pressure, it overcomes the spring and presses back the diaphragm C with the valve F, and passes through the tubes G H to the tap-operating diaphragm or bell, and causes it to move the tap in the required manner. As soon as the pressure is reduced, the valve F again closes the passage and the tap-operating diaphragm cannot be reoperated until the pressure has fallen sufficiently low for the spring I to withdraw the left diaphragm, with its valve, from the passage, and allow the gas to return into the case, from which it escapes through the outlet J.

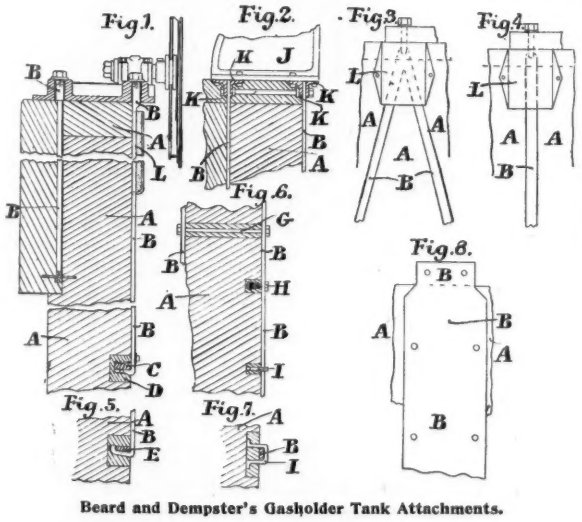
In fig. 2, a very similar inlet-controlling diaphragm is employed; but in this case the gas from the main passes through the pipe A connecting the space between the side B and the diaphragm C; its action on the diaphragm being the same as in the previous figure. But in this case, after the tap-operating diaphragm D has, by means of the rod, moved the tap through the lever E carrying a ratchet which engages with the wheel F, the gas is allowed to slowly escape through the passage G provided with a throttling screw.

Gasholder Tank Attachments.

BEARD, G. F. H., and R. & J. DEMPSTER, LIMITED, of Manchester.

No. 235; Jan. 5, 1909.

This invention relates to attachments, or holding-down bolts or plates for the standards of ordinary gasholders, or for the base-plates of the carriages for spirally-guided holders; and it is more particularly applicable in cases where it is desirable to introduce new or additional holding-down means without largely disturbing the existing tank—such as when a holder of increased capacity is to be adapted to the existing tank.



Beard and Dempster's Gasholder Tank Attachments.

Fig. 1 shows the roller carriage base-plate of a spirally-guided holder attached to the tank wall by one form of the improved holding-down bolts or plates. Fig. 2 shows an adaptation of the bolts or plates to the standard of an ordinary column gasholder. Figs. 3 and 4 are portions of the tank face, chiefly illustrating two forms of holding-down bolts or plates for attachment thereto. Fig. 5 is a detail of a holding-down bolt or plate adapted for attachment to, or abutment with, the tank wall. Fig. 6 shows other connecting means. Fig. 7 is a detail of fig. 6. Fig. 8 is a front elevation of a form of holding-down plate suitable for use with ordinary column holders (as fig. 2).

In fig. 1, a bolt B on the inner face of the tank wall is provided with a bent portion or projection passing into the wall A, and above which projection is a metal anchor block C; the whole being firmly embedded in cement at D. The holding bolt at the outer face of the tank is provided with a projecting portion in the form of a plate, which, after fixture, is built in with cement or the like. In fig. 5, the extremity of the bolt B is provided with a projection turned up at the end so as to enter, or pass through, an aperture in a plate E.

Different means for attachment of the bolts or plates, and suitable for application at any part of the tank wall, are shown in fig. 6, in which G is a cross bolt, H is a rag bolt, and I is a clip. A plan of this clip, embracing the bolt B, is indicated in fig. 7; the projecting ends of the clip being embedded in cement, filling up a cavity in the wall at that part.

In fig. 2, the bottom plate of the standard J of a column gasholder is shown provided with angle irons K for the purpose of attachment to the holding-down bolts or plates B; a cross bolt being passed through from the inside to the outside, and the whole embedded in cement or the like.

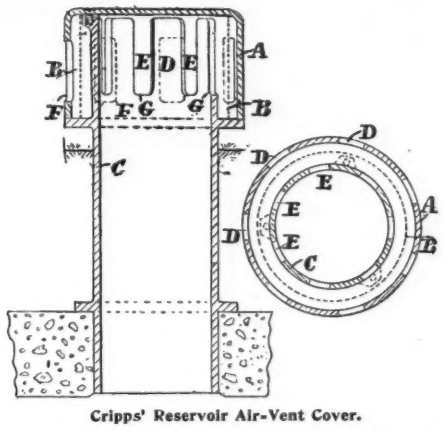
In figs. 1, 3, and 4, a plate or one form of casing L is shown in the neighbourhood of the water-line within the tank, so as to prevent corrosion of the holding-down bolts or plates; the cavity formed by such casing being, in this example, also filled with cement or like material for the same purpose. But if desired, the face of the tank wall may be grooved to receive any part, or the whole, of the holding-down bolt or plate; the same being covered over with, or embedded in, cement or like material.

Air-Vents for Water Reservoirs.

CRIPPS, F. S., of King William Street, E.C.

No. 4717; Feb. 26, 1909.

The patentee proposes to construct three concentric cylinders to be placed over the air-pipes inserted in the tops of covered water reservoirs, so as to exclude all foreign matter (living or dead) from finding access to the interior through the vents.



Cripps' Reservoir Air-Vent Cover.

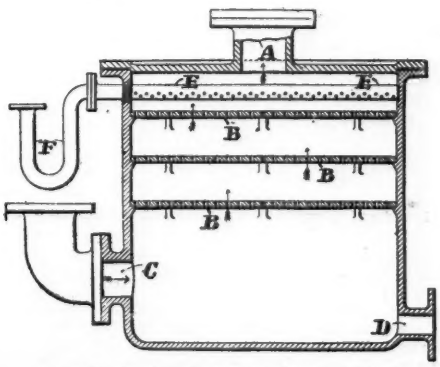
It consists, substantially, of three concentric metal cylinders or pipes. The outer one A forms a hood closing the tops and enveloping the other two, B and C. The outer and inner cylinders have slot holes D E, which baffle one another—that is, a hole in one is midway between two holes in the other, and the sill of any hole F in the outer cylinder is lower than the sill or bottom of any hole G in the inner one, so that rain water driving into the outer cylinder drains out again, instead of passing into the reservoir through the holes in the inner cylinder. The cylinder B is constructed of wire gauze, which acts as a baffle to the wind or rain beating in, and also excludes dust and other objects from being passed into the reservoir.

Suction or Pressure Producer-Gas Plants.

OSWALD, T. H., SEN. and JUN., of Fenchurch Street, E.C.

No. 11,639; May 17, 1909.

This invention relates to suction or pressure producer-gas plants, when fitted with means for dealing with the waste water discharged from the scrubbers; and the claim is to provide "means for purifying or ridding the waste water from noxious and poisonous gases—mainly sulphuretted hydrogen."



Oswald's Suction-Gas Waste-Water Purifier.

For suction-gas plant, the chamber is made of suitab'e proportions and capacity and of any convenient form in transverse section. It is fitted with a cover furnished at its upper part with a flanged extension to which is attached a pipe connecting with the generator (not shown). Transversely of the chamber are arranged any number of perforated plates or partitions B, of suitable thickness and mesh, and preferably divided diametrically into two equal portions, supported on projecting lugs, so as to provide for their easy fitment in place and ready removal for cleaning purposes. C is the air inlet to the chamber, attached to an upward turning elbow-pipe. D is the outlet or discharge from the chamber for carrying away the purified waste water. Transversely across the upper portion of the chamber are pipes E, held in position

by a screwed collar and a recess in the inner wall of the vessel. To the outer flanged end of the pipe is connected a U-shaped pipe F, which is joined on to the waste-water pipe leading from the scrubbers (not shown).

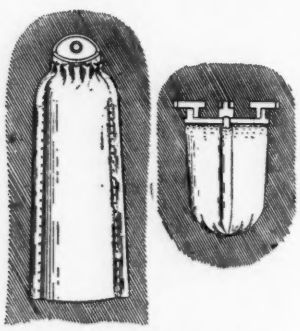
When the plant is in operation, the waste water discharging from the scrubbers flows through the pipes F and E into the chamber, where it is broken up into fine streams by the perforations in the said pipe E and the perforated plates B, and in its downward flow is brought into contact with the air coming in at C and passing upwards through the vessel. The diffused and purified water, falling to the bottom, discharges at D to any convenient waste. The U-shaped pipe F is employed to constitute a water seal.

Incandescent Gas-Mantles.

Fisk, J. W., of Cardiff.

No. 11,315; May 13, 1909.

This invention consists in providing the solid rings of incandescent gas-mantles with dependent lugs to engage a mantle specially adapted thereto, and in gathering the fabric of the mantles (both upright and inverted) in such a manner as to form external vertical tubular frills, into the upper ends of which the dependent lugs are inserted as into sleeves.



Fisk's Incandescent Mantles.

The annular solid crown-piece for the upright mantle has attached to it the mantle by a cord or thread tightened around a peripheral groove in the crown, which is provided with a bridge having a hole by means of which the mantle is supported by external wire holders. From the crown depend lugs, which enter the upper ends of tubular vertical frills formed externally on the mantle by gathering the fabric by vertical seams, as shown.

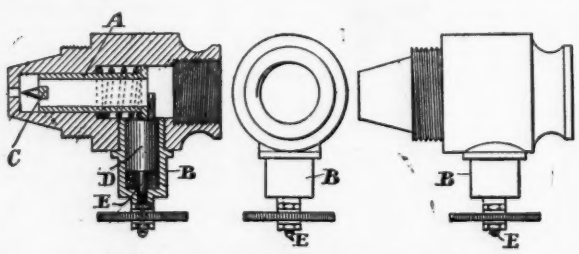
The dependent lugs and frills are also applied to inverted mantles as represented.

Regulator for Atmospheric Gas-Burners.

Bland, C. W., of Little Trinity Lane, and Glover, T., of Queen Victoria Street, E.C.

No. 11,826; May 19, 1909.

The object of this invention is to construct a device for regulating the inflow of gas to atmospheric burners (especially those used for inverted incandescent lighting) in such a manner that the needle valve is always kept central in its hole, and is easily manipulated and held in the desired position.



Bland and Glover's Atmospheric Burner Regulator.

The inventors form a socket piece with a hole through it of four different diameters—one provided with a screw thread for attachment to the gas-pipe; two others for receiving the valve A; the other being the needle hole, near the outside of which is a screw thread for attachment of the gas and air mixing chamber and the burner. At right angles to the hole in the socket is a screw thread hole, to which is connected a spindle casing B having an end provided with a small hole.

The valve A, which fits in two diameters of the hole in the socket, is hollow; and its body is made to fit nicely and smoothly in the smaller diameter hole with a flange at top fitting nicely the larger diameter hole. The base of the valve is provided with a bridge C, from which projects a needle, which finds a position in or near to the needle hole in the socket; and by reason of the length of the hollow valve A, and its nicety and ease of fit in the socket, the valve moves always in a straight line without any side movement, and the needle is always in proper position with regard to the needle hole.

Surrounding the hollow valve is a helical spring, which normally tends to keep the valve upward and the needle in such position that the needle hole is clear for the maximum passage of gas.

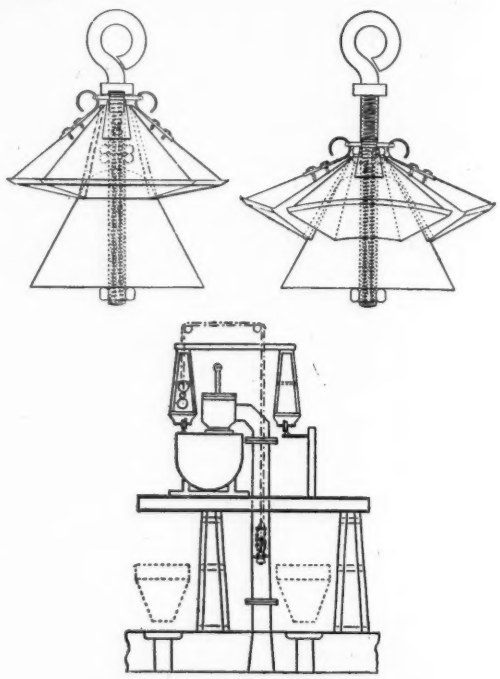
Inside the spindle casing B is fitted a spindle having one portion D fitting nicely and with a certain amount of grip with the spindle casing; the other portion E being of a smaller diameter and screw-threaded, and passing out through the hole in the end of the casing, where it is provided with a thumb button held by a lock-nut. Should the heat of the gas cause shrinkage of the packing, and, in consequence, leakage of gas, by turning the lock-nuts the packing is readily tightened in the casing and the leakage stopped.

Removing Carbon from Ascension Pipes in Coke and Gas Works.

Thau, A., of Spennymoor, Durham.

No. 19,382; Aug. 23, 1909.

This invention consists in the provision of a series of scrapers loosely arranged on a screw-threaded bolt having on its lower portion a cone which, when the bolt is pulled, spreads the scrapers out against the walls of the pipe; the device being operated by two rope pulls arranged in a travelling crane, and connected, one to the scrapers and the other to the bolt.



Thau's Ascension-Pipe Scraper.

As shown, the scrapers are suspended round a cone mounted on the lower part of a bolt, so that, when the device is connected to the scrapers, the latter are held in inoperative position, and when it is pulled through the pipe by means of a rope connected to the bolt, the scrapers are spread out by the cone so as to engage the walls of the pipe and clean the latter. The hollow cone has a cutting edge round its base; and a nut (with lock-nut) arranged on the bolt underneath the ring allows the spreading-out of the scrapers to be regulated.

A crane is provided adapted to travel over and along a set of ascension pipes, with drums mounted on rotatable shafts in the crane. One of the drums is connected by means of a chain to the scrapers of the cleaning device, and the other by means of a rope to the bolt on which the scrapers are arranged. A pinion slidably feathered on a shaft, so as to be capable of being brought in and out of engagement with spur-wheels, is mounted on the shaft of the drums; and a crank handle, adapted to fit on any of the shafts, allows the cleaning device to be lowered through the ascension pipe into its inoperative position, and raised through it into its operative position for scraping the pipe when desired.

Gaslight and Coke Company's Training Scheme for Lads.

In connection with the Gaslight and Coke Company's scheme for training boys for their service, the London County Council undertook in the summer of last year to recommend 24 suitable boys for admission to a two years' course of training in the Company's workshops, and to provide instruction for them at the Westminster Technical Institute. The instruction was to consist of workshop arithmetic, mechanical drawing and sketching, English composition, and elementary mechanics (or physics and chemistry), on three half days a week. The Company found that, owing to the boys in the second year of the course being sent daily to various parts of the country, it would not be possible to adhere to the arrangement. They suggested, however, that the boys should attend the institute for one whole day a week. At the meeting of the Council last Tuesday, the Education Committee recommended that the resolution of June 30, 1908, should be rescinded, and that the Council should undertake to provide instruction at the Westminster Technical Institute on one whole day a week for boys in the second year of their training to become gas-fitters in the employ of the Company. The recommendation was passed without discussion.

The Welsbach Incandescent Gaslight Company, Limited, have declared a dividend of 6 per cent. for the half year ended the 30th of September last.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Hamburg Gasholder Disaster—Air-Testing of Plant.

SIR,—The terrible disaster at the Hamburg Gas-Works and its fatal consequences cannot fail to attract the attention and sympathy of everyone connected with the industry. I, for one, have been particularly impressed by the sad news, if only for the sentimental reason of having been on the Grasbrook works, and stood under the ill-fated holder, two days previous to the catastrophe.

It would be idle to ascribe the occurrence to any definite cause before the official inquiry is concluded, and all details are known. However, from the accounts to hand, it seems pretty certain that a charge of air had been used to test the new holder for gas-tightness. Whether a residual quantity of this air was left over when filling operations commenced, we cannot say; and the presence of an explosive mixture is denied from several quarters. I was informed, during my inspection of the works, that experiments had been going on to ascertain the action on incandescent mantles of the non-luminous gas drawn from the first charge of the holder. At the time, I put the non-luminosity of the gas down partly to the preferential dissolving power of the unsaturated tank water, and partly to some air not removed from the holder. But I should like to point out that these experiments were conducted some days before the disaster occurred; and there must have been a considerable alteration of conditions by that time. The primary cause may, or may not, have been due to the firing of an explosive mixture; but, if present, it must have precipitated matters, and influenced the consequences.

Seeing that the testing of units of gas plant by air pressure is not an uncommon—if not the usual—practice, I venture to make a suggestion, to obviate or lessen the risks attached to such a procedure. Could it not be made a rule—possibly to be embodied in factory regulations—to carry out these tests with a more or less inert gas, such as ordinary combustion gases? All that would be required would be to connect the suction of the blower or compressor employed to a pipe coming from a flue or chimney; and a small coke scrubber for cooling and cleaning, and, if necessary, a limestone scrubber for removing sulphur dioxide, might be advantageously interposed. If, for instance, purifier-boxes were blown out with this inert gas before removing the lids, the not infrequent explosions by spontaneous ignition could in most cases be avoided. This would greatly reduce the number of casualties debited to the gas industry—to the chagrin of those who are only too ready to make use of accidents of this kind for the purpose of competitive propaganda.

R. LESSING.

Southampton House, 317, High Holborn, W.C., Dec. 18, 1909.

The Catastrophe at the Hamburg Gas-Works.

SIR,—In your issue of the 14th inst., you publish a letter from Mr. F. S. Cripps, in reference to the above, in which he says: "The 'Mirror' stated the holder to be 7,060,000 cubic feet, which is 71 per cent. *less* than the 12,000,000 cubic feet holder of the South Metropolitan Gas Company."

Is this correct? Surely the figure should be 41 per cent.

Of course, the holder of the South Metropolitan Gas Company is 71 per cent. *larger* than the one at Hamburg.

Probably this is what Mr. Cripps meant.

J. W. WHIMSTER.

Lower Sydenham, S.E., Dec. 17, 1909.

The Gas Heating Field.

SIR,—Since your valuable articles (Sept. 3 and Oct. 15, 1907, and July 1, 1908) upon this subject were published, many things have tended to concentrate attention upon it, and considerable progress has been made.

It is becoming more than ever recognized that gas is an economical and effective heating agent, and that its use is an invaluable aid to comfort and health. So far as can be generally ascertained at present, this season promises to produce a record for the increased adoption of gas-heating appliances, while a spirit of optimism is abroad respecting the future of gas-heating.

Gas undertakings generally are assisting in the effort; but a yet bolder policy must be adopted to ensure reaching the ultimate goal. Rentals for gas appliances are being reduced to vanishing point, even where they have not been altogether abolished. After all, a merely nominal rental is perhaps the best safeguard against the indiscriminate adoption of unnecessary apparatus, with its consequent needless addition to capital expenditure. The manufacturers of such apparatus are fully entitled to the gratitude of the gas industry for their splendid efforts in designing and producing suitable types at a reasonable cost; and great improvement has recently been made in this direction. The medical profession, too, is recognizing the usefulness and hygienic value of properly designed and fixed gas-fires; and its recommendation will undoubtedly increase the popularity as well as the importance of these appliances.

Much, however, yet remains to be done to enlist the sympathy and assistance of architects and builders. One of the chief difficulties to be surmounted is that caused by the unsuitability of most houses for the fixing of gas apparatus to the best advantage. How many homes might be improved by the adoption of gas-heating apparatus, if adequate provision had been made for them in the original design. There is also a great natural objection to having floors ripped up, and walls damaged, in laying supply pipes. In a new design, it would be an easy matter to provide a covered channel for pipes; and this would be of untold advantage whenever an examination was necessary. It should be considered important to bring this matter very strongly before the notice of those responsible for the design of dwelling houses. Public authorities, too, may do much to reduce the smoke nuisance by advocating the use of purified gas for heating purposes; and experiments such as are now being carried on by some of the largest gas undertakings will be most useful in forwarding this object.

It may be added that in Huddersfield, the differential charges in force (for lighting, 2s. per 1000 cubic feet, and for heating and power, 1s. 6d.) have proved advantageous, and are undoubtedly preferable to a flat-rate, as the following figures partially demonstrate.

The gas sold for stoves, engines, &c., in the year ending March, 1898, was 81,700,000 cubic feet; and in the year ending March, 1909, 247,631,000 cubic feet—being an increase of over 200 per cent. in the eleven years.

In addition to the above, a large proportion of the gas sold through prepayment meters (6,127,000 cubic feet in 1898, and 214,300,000 cubic feet in 1909) is used for heating purposes. What the exact proportion is, there are no means of determining; but taking it at one-half, the total gas used for heating purposes, it will be as follows: Year ending March, 1898, 84,763,000 cubic feet; year ending March, 1909, 354,781,000 cubic feet—showing an increase in the eleven years of 270,018,000 cubic feet, or 318 per cent.

The dogged perseverance in attacking the problem of gas-heating that you have so often advocated, is having remarkable results all over the country.

EDWARD A. HARMAN.

Huddersfield, Dec. 18, 1909.

Gas-Stoves for Heating Aviaries and Bird-Rooms.

SIR,—In taking up the cudgels against the inconsequential abuse of gas as a heating and lighting agent from a hygienic point of view, Mr. D. H. Helps, in his letter in the "JOURNAL" for the 7th inst., in no way overstates his case. Hundreds of gas-stoves are to-day used in aviaries and bird-rooms by bird fanciers throughout the country. Breeders are even enthusiastic in their praises of this means of maintaining the aviary at a uniform temperature, and at the same time keeping the birds in perfect condition.

One well-known fancier (Mr. Henry J. Fulljames) writes in "Canary and Cage Bird Life," for Nov. 24, 1905, as follows:—

> Some twelve or more years ago, I was visiting a friend at Weymouth who had a very fine collection of choice exotic ferns, and while I was listening to his recital of the history of the principal plants in his collection, I noticed that the frost which was prevailing at the time was being kept out of his fernery by the aid of a Clark's "Syphon" gas-stove. Knowing that, of all living things likely to be susceptible to deleterious fumes, such plants as those in the possession of which my friend delighted would be the very first to be injuriously affected, I asked him if he noticed none of such ill-effects as might be expected to be consequent upon his means of heating. For reply he referred me to the condition of his collection, and I decided that what was good enough for tropical ferns was good enough for tropical birds; and immediately upon my return to my home, I installed one of the stoves in my bird-room, in which I was at the time keeping some 200 foreign birds. My experience justifies me in fully recommending this method of heating a bird-room.

This practical testimony to the non-injurious effect upon plant and bird life of gas used as a heating agent surely combats effectually the absurd notion that the atmosphere is charged with sulphuretted hydrogen and other terribly poisonous products wherever gas is used.

F. HATCHER.

Canonbury Road, N., Dec. 15, 1909.

PARLIAMENTARY INTELLIGENCE.

GAS COMPANIES (STANDARD BURNER) BILL.

Friday was the last day for depositing in the Private Bill Office copies of Bills promoted for the ensuing session. One of the principal measures, so far as gas companies are concerned, is the above-named Bill, which, as already mentioned when dealing with the statutory notices, provides for the adoption of the "Metropolitan" No. 2 burner as a standard, in substitution for the various burners now in use for the official testing of the illuminating power of gas. We have received from the Parliamentary Agents (Messrs. R. W. Cooper and Sons) an early print of the Bill, and are thus enabled to indicate its scope. As our readers are aware, it is being promoted jointly by a number of companies, whose names, which are attached to three separate Bills, were given in the "JOURNAL" for the 23rd ult. (p. 548).

The preamble sets forth that by the City of London Gas Act, 1868, Parliament prescribed that the burner to be used for testing the illuminating power of gas supplied in the City of London should be "such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer." It then goes on to say that the Gas-Works Clauses Act, 1871, enacts that the illuminating power of gas supplied by the various gas undertakings of the kingdom should be tested by burners to be prescribed by the Special Act relating to each company, none of which burners (with the exception of the burner prescribed in all Gas Acts of recent date, and subsequently referred to) fulfil the conditions prescribed, or meet the requirements essential for a fair and scientifically accurate test for illuminating power. The Metropolitan Gas Referees, after careful experiment, have satisfied themselves that the burner known as the "Metropolitan" argand No. 2 is the best known burner for testing the illuminating power of gas; and since the year 1906 they have adopted it for the purpose of testing the illuminating power of the gas supplied by the three Metropolitan Companies. It has been proved that this burner gives a fair and true result for all qualities of gas up to an illuminating power of 20 candles, which limit covers the statutory obligations of all the Companies enumerated in the first schedule.

The burner alluded to is now invariably prescribed in all Acts and Provisional Orders conferring powers of supply upon gas companies and local authorities, as also in Acts and Provisional Orders promoted by existing companies and local authorities for obtaining further powers. The several promoting Companies are consequently desirous of having the "Metropolitan" No. 2 burner substituted for the one prescribed in the Acts or Orders relating to their respective undertakings. The clauses of the Bill are then given, as follows:—

1.—This Act may be cited for all purposes as "The Gas Companies (Standard Burner) Act, 1910."

2.—"Prescribed burner" means the burner prescribed pursuant to the provisions of the Gas-Works Clauses Act, 1871, in any Act or Order relating respectively to the promoting Companies. The "standard burner" means the Metropolitan argand burner No. 2, described by the Metropolitan Gas Referees in their Notification for the year 1908 (a model of which burner has been deposited with the Warden of the Standards), or any other burner which the Board of Trade may approve under the provisions of this Act as being equally or more suitable for the testing for illuminating power.

3.—This Act shall come into operation on the 1st day of January, 1911.

4.—Notwithstanding anything in any Acts or Orders relating to the promoting Companies contained, the testing for illuminating power of the gas supplied by the promoting Companies shall, subject to the provisions of this Act, be by means of the standard burner, which shall be deemed to be the prescribed burner within the meaning of the Gas-Works Clauses Act, 1871, for the purposes of any test for illuminating power under that Act and the Acts and Orders set forth in the first schedule to this Act; and such Acts and Orders are hereby severally amended, and shall be read and have effect accordingly: Provided that the Board of Trade may, on the application of the company or the local authority concerned, approve the use of any other burner the chimney and burner-holes of which may have other dimensions, and which may appear to the Board to be equally or more suitable for the testing: Provided, further, that such other burner shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer.

5.—The following conditions shall be observed when testing with the standard burner:—

(1) The glass chimney to be used with the standard burner shall be 6 inches in length by $1\frac{5}{8}$ inches in internal diameter.

(2) The gas shall be consumed in the standard burner at the rate of 5 cubic feet per hour, and the air supply thereto shall be adjusted according to the regulations contained in Part I. of the second schedule to this Act.

(3) If the gas is so rich that it cannot be burned with the full air supply and at the prescribed rate of consumption without tailing above the chimney, the rate of consumption shall be reduced until the flame burns properly within the chimney, as described in the said second schedule. The rate of consumption shall then be carefully ascertained, and from this the illuminating power of the gas under test shall be calculated by simple proportion for any reduction of such rate of consumption below 5 cubic feet per hour.

(4) Proper correction shall be made, according to the method set forth in Parts II. and III. of the second schedule to this Act, for variation from standard atmospheric conditions of 30 inches height of mercury pressure and 60 degrees Fahrenheit.

6.—All costs, charges, and expenses of and incident to the preparing for, obtaining, and passing of, this Act, or otherwise in relation thereto, shall be paid by the promoting Companies.

The first schedule contains the names of the promoting Companies and the Acts or Orders to be amended. The second schedule contains: (1) Regulations for using the standard burner; (2) regulations as to correcting to standard temperature and pressure; (3) table to facilitate the correction of the volume of gas at different temperatures and under different atmospheric pressures.

LEGAL INTELLIGENCE.

THE PORTSMOUTH WATER-APPROPRIATION CASE.

Judgment for the Portsmouth Water Company.

In recent issues of the "JOURNAL" (see *ante*, pp. 626, 686), we reported the proceedings in an action brought by the Portsmouth Water Company against the London, Brighton, and South Coast Railway, to restrain them from taking water from a spring, termed the "Railway" spring, on their land at Bedhampton, near Portsmouth. The case, which extended over several days, was tried by Mr. Justice PARKER, who reserved judgment. This was delivered last Wednesday.

His LORDSHIP said the action related to the respective rights of the Water Company and the Railway Company in the water rising from a spring situate on the latter Company's land, and known as the Railway spring. The site of it was formerly in the bed of a millpond situated immediately above, and used in connection with, the Upper Bedhampton Mill. In the year 1848, the mill and millpond belonged to two gentlemen named Stoneham. The water, after passing through the mill or over the weirs, flowed to, and was used to work, another mill known as the Lower Bedhampton Mill, which in 1848 belonged to other owners. Both mills appear to be of considerable antiquity; and the inference he drew from the facts proved was that the millpond was originally formed by placing a dam at the Upper Bedhampton Mill across the bed of a natural stream—the effect being to back the water up the channel and its tributaries, causing them to overflow their original banks, and thus constituting a millpond. If the person who erected the dam owned all the land affected by the backing-up of the water, the dam could not give any cause of complaint to upper riparian owners. With regard to lower riparian owners, their rights would in no way be affected by the existence of the dam if the water from the natural stream and its tributaries still flowed undiminished in quantity either through the mill or over the dam and weirs. The various sources from which the millpond was supplied with water at the date named included Wyatt's spring, situate in the bed of the pond; the two Bidbury springs, situated, together with the channels by which the water therefrom reached the pond, on land belonging to the Stonehams; and a stream coming to the pond on the east from various other springs, among which were those known as Blue Hole springs and St. Chad's Well—the latter stream being also intermittently fed with water from a brook known as the Hermitage. According to the plaintiffs' contention, the Railway spring was yet another important source of supply. The defendants, on the other hand, alleged that such spring had no existence until the year 1901 or 1902. On the evidence, he came to the conclusion that in 1848 this spring did exist, and yielded a considerable supply of water, which passed through the millpond to the upper, and thence to the lower, mill. He further found that but for the existence of the dam the water from this spring would have flowed, and when the millpond was emptied by raising the mill hatches did in fact flow, in a defined channel from the spring head into another defined channel, which brought down the waters from the Bidbury springs to the mill. Under these circumstances, it followed that the Stonehams were not entitled in 1848, as against the then owners of the Lower Bedhampton Mill, to interfere with the accustomed flow of water either from the Bidbury springs or the Railway spring.

In the year 1848, the predecessors in title of the defendants required a portion of the millpond; and they bought this land from the Stonehams under a conveyance dated Aug. 16, 1848. The portion thus acquired extended right across the bed of the pond from east to west, and included the site of the Railway spring, a small part of the channel by which, when the pond was emptied, the water from this spring reached the channel that brought down the water from the Bidbury springs to the Mill, and part of the latter channel. The conveyance contained a recital, among others, to the effect that the Railway Company had agreed in nowise prejudically to obstruct the full flow of water in the stream to the millpond under the works constructed or to be thereafter constructed. The part of the millpond conveyed was described as "all that piece or parcel of land covered with water, being a portion of the said millpond, except and reserved unto the grantors the full flow of water into the said channel from the said stream." Two interpretations of these words had been suggested. Mr. Buckmaster (for the plaintiffs) contended that the flow of water in the stream to the millpond included all the water passing from the part of the pond which was sold to that which was retained by the vendors, and therefore included the water from the Railway spring; whereas Mr. Younger, on the other side, contended that the words referred only to the stream from the Bidbury springs, which at the date of the conveyance came from the north of the land sold to the Railway Company, passed under their existing bridge, and thence flowed to the mill. The latter interpretation seemed most in accordance with the words used; but he could not accept the argument founded on it, that the exception and reservation of the full flow of water from the Bidbury stream implied a grant of the full flow of water from the Railway spring—a grant of a right in the nature of an easement, by virtue of which the Railway Company could impound and divert altogether the water from the spring. His conclusion was that the exception and reservation left unaffected the rights of both the Stonehams and the Railway Company in the water from the Railway spring; and that in regard to this water they respectively became, by virtue of the conveyance, upper and lower riparian owners. In other words, after the execution of the conveyance the Stonehams were entitled, just as the owners of the Lower Bedhampton Mill were entitled, to have the water from this spring flow in its accustomed channel, undiminished by the Railway Company except to the extent to which the Company could justify its diminution by virtue of their rights as upper riparian owners.

It remained to be considered whether the rights referred to had been altered by anything which had happened since the conveyance. On Aug. 1, 1877, the Water Company acquired the Lower Bedhampton Mill—their purchase including all the land on both sides of the stream from the Upper Bedhampton Mill down to the sea; so that they were entitled to use the water coming down without reference to the rights of any lower riparian owner. On Dec. 1, 1880, they acquired the Upper Bedhampton Mill, the millpond, the Bidbury springs, and the channel which brought down the water therefrom to the mill, except in so far as the pond and the last-mentioned channel had been conveyed to the Railway Company in 1848. In 1889, they enclosed Wyatt's spring, carried a pipe from it to their pumping-station, and began to utilize the water for the purposes of their undertaking. This they could lawfully do, as there was no lower riparian owner whose rights had to be considered. Similarly, in 1898 they enclosed the two Bidbury springs, and in one of them sunk a cylinder in order to concentrate the flow of the water. In another they made a boring down to the chalk, which, according to the evidence, was the natural reservoir that supplied all these springs with water. There was some evidence that this boring, when open, diminished to a certain extent the supply of water in the Railway spring; but he came to the conclusion that, notwithstanding the work done in connection with the Bidbury springs in 1898, the Railway spring still continued to yield a considerable quantity of water. After enclosing the two Bidbury springs, pipes were laid from them connecting with the pipe from Wyatt's spring to the Company's pumping-station, each pipe having an overflow into the millpond considerably to the south of the land sold to the Railway Company. At the same time, a pipe was laid for surface-water drainage from the north side of the railway under the bridge, so as to have an outlet in the millpond south of the Railway Company's land. These pipes were laid through the land of the latter Company by arrangement with them; and the result was that it became possible to fill up the millpond under the bridge without interfering with the flow of water from the Bidbury springs, or of surface water from the north of the railway. In the year 1901, the Water Company proposed two further schemes. First, they contemplated laying a 36-inch main from their pumping-station across the millpond and

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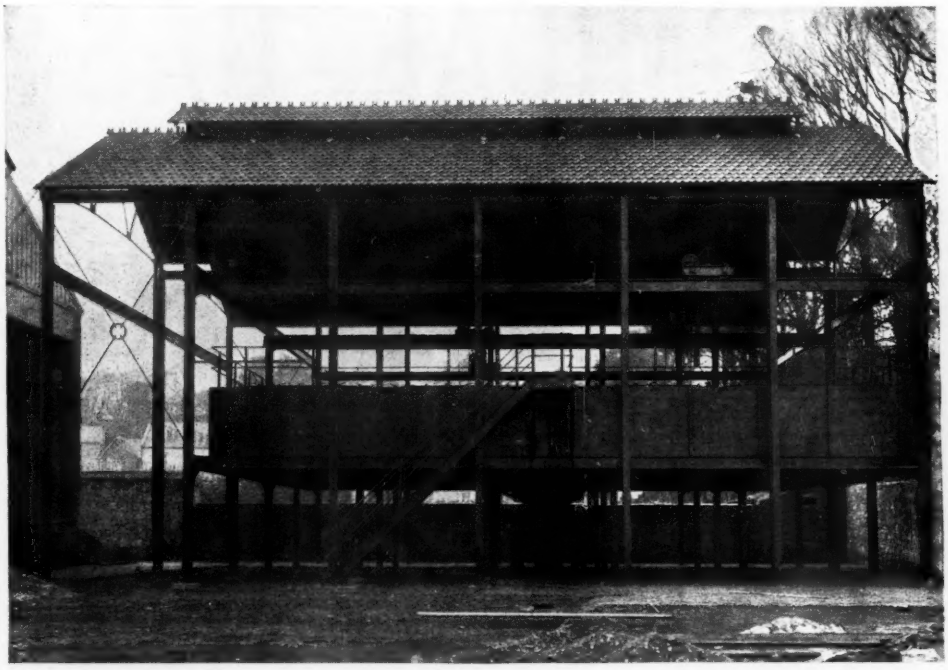

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LATEST DESIGN.

under the railway line; and, secondly, constructing a private siding partly on the Railway Company's land and partly on their own. For the execution of both projects some arrangement with the Railway Company was necessary. The arrangement come to in regard to the 36-inch main was ultimately embodied in an agreement dated June 13, 1901; and that as to the siding in another dated Dec. 3, 1901. After reading certain clauses of the first agreement, his Lordship said it was argued that this agreement authorized the Railway Company to fill up all the millpond so far as it had been conveyed to them in 1848, and therefore inferentially to fill up the site of the Railway spring, and divert its waters to their own use. But, in his opinion, it was reasonably clear that all they were authorized to do was to fill up the part which was on their own land of the disused channel which formerly brought down the water of the Bidbury springs to the mill. The channel from the Railway spring was at the date of the agreement in no sense a disused channel, but continued then to bring down, as it had always done, the waters of the spring to their point of junction with the channel from the Bidbury springs. This agreement, therefore, did not in any way affect the rights of the respective parties in the waters of the Railway spring. It was not necessary to consider the provisions of the agreement of Dec. 3, 1901, which provided only for the construction of the contemplated siding. The actual work in respect of both these schemes commenced before the date of the earlier of the two agreements; the work being carried on more or less contemporaneously. Before commencing the embankment, the Water Company put down a 42-inch pipe at right angles to its proposed line, for the purpose of carrying the water from the pond to the north to the pond south of it. The only water in the northern part was then the water coming from the Railway spring; the overflow from the Bidbury springs being south of the embankment. The first soil applied to form the embankment over this 42-inch pipe seemed to have been excavated from the millpond in digging holes for the piers on which the 36-inch main was to be carried; and in digging a hole in the immediate neighbourhood of the Railway spring the workmen were inconvenienced by the water, which appeared to have been flowing in considerable quantities. It was not, in his opinion, the fact that the Railway spring originated, or that its yield was materially increased, by anything done in the laying of the 36-inch main, or during the construction of the embankment. The two schemes were in due course carried out; and, until further works were erected, the water from the Railway spring flowed, as it had previously done, down to the Upper Bedhampton Mill, except that it was carried from north to south of the embankment by means of the 42-inch pipe. In his opinion, the respective rights of the parties remained unaltered.

In 1902, the Water Company proposed, with a view of preventing the water from the Railway spring being contaminated with surface water from the north, to construct a retaining-wall, partly on their own land and partly on that of the Railway Company; and they approached the latter in order to obtain their consent. Thereupon the Railway Company claimed the sole right to take and use the water of the Railway spring. The Water Company denied the validity of this claim; alleging that they and their predecessors had hitherto taken and used, and they claimed the right to take and use, the water flowing from the spring, notwithstanding that the spring was on the Railway Company's land. Under these circumstances, the parties came to an arrangement embodied in the agreement of Sept. 27, 1902, under which the Water Company were to be at liberty to make the proposed retaining wall on certain terms then specified. The agreement was determinable after four years by six months' notice by either party; and on its determination, the Water Company were, if required, to remove the wall, and restore the land to its former condition. The rights of the parties, whatever they might be, existing at the date of the agreement, were to be revived, and be in full force as soon as the agreement determined. Subsequently the idea of making the wall was abandoned; and, in lieu thereof, the Water Company, with the consent of the Railway Company, sank a cylinder in the Railway spring, in order to concentrate the waters as far as possible, and surrounded it with a retaining wall—enclosing the spring. From the interior of the spring they carried a pipe emptying into the 42-inch pipe under the embankment. The pond north of the embankment thus became dry, and was filled up by the parties—the old bridge being removed. By an agreement dated July 7, 1905, the cylinder and retaining-wall thus constructed were substituted for the wall mentioned in the agreement of Sept. 27, 1902. As from Sept. 29, 1907, this agreement was determined by the Railway Company; and it thereupon became necessary to define the rights of the two Companies in the water of the Railway spring as they existed prior to the date of the agreement. These rights, in his opinion, were then, and still remained, the usual rights of upper and lower riparian owners respectively; and, consequently, the Water Company, as lower riparian owners, were still entitled to have the water from the spring flow through the 42-inch pipe into their pond south of the embankment undiminished in quantity, except to the extent to which the Railway Company could justify such diminution under their rights as upper riparian owners.

The Railway Company's contention that they were entitled to all the water of the spring because it rose on their land, and their threat to impound and divert all such water to their own use, could not, in his opinion, be upheld or justified. This disposed of the greater part of the action. It was, however, suggested that the sinking of the cylinder in the Railway spring had largely increased its yield of water; and it was contended that the Railway Company were exclusively entitled to such increase. This was not an issue raised upon the pleadings; and even if the Railway Company were right in their contention, he was clearly of opinion that where an upper riparian owner alleged that he had increased by artificial means the flow of water from a spring the water of which ought *primâ facie* to come down to a lower riparian owner, the onus of proving the fact and the amount of such increase rested with the upper riparian owner, who, as a condition of enforcing his rights, would be required to prove what was the extent of the flow before the artificial means were applied. The Railway Company had not, in this respect, discharged the onus of proof. The sinking of a cylinder in the spring might, of course, have increased the flow, by removing obstruction to the rising water. But there was no real evidence that it did so; and it was highly improbable, on the evidence, that the water now rising in the spring had anything in common with that found under the railway line during the excavations for the 36-inch main, even if such water were really spring and not surface water.

He should therefore declare that the respective rights of the plaintiffs and defendants in the water of the Railway spring were, at the date of the agreement of Sept. 27, 1902, the ordinary rights of lower and upper riparian owners respectively; and that on the determination of this agreement, as modified by that of July 7, 1905, such rights revived and became again of full force. He therefore proposed to grant an injunction restraining the defendants from diverting, intercepting, or otherwise dealing with the Railway spring or the water in such manner as to interfere with the rights of the plaintiffs referred to in the declaration. Defendants must pay the plaintiffs' costs of the action.

A stay of execution for one month was granted to allow of certain mechanical arrangements being made to enable the defendants to comply with his Lordship's declaration.

DISPUTED WATER-RATE FOR BUSINESS PREMISES.

A short time ago, Deputy-Judge Lush, sitting at the Westminster County Court, had before him a claim by the Metropolitan Water Board for five quarters' rate for water supplied to Messrs. Baker, carpet manufacturers and importers, of Warwick Square and Newgate Street, London. The case for the Board, for whom Mr. A. B. Shaw appeared, was that defendants occupied two buildings, with separate entrances, and used the two premises as one whole. The New River Company's charges were continued until the Board's new Act came into force on April 1, 1908, when they were bound to follow the City rating authority, and make revised charges on the same lines. The rate-book showed two assessments, and the Board made two, at the usual 5 per cent. on the rateable value of the premises. The claim was for £34 0s. 10d. for five quarters under the revised charges. If the Board were wrong, the owner or occupier of adjoining premises might have a supply to one cut off, use the water supplied to one for both, and pay one rate, even though the premises to which the supply pipe went were assessed at a low value and the adjoining premises at a high one. There was intercommunication between the premises occupied by defendants, who used them as one building. For the defendants, who were represented by Mr. Drucquer, evidence was given that a well on the premises when defendants went into possession was now the source of water supply to the whole of the premises. There were seven numbers in Warwick Square, and formerly the buildings were assessed in three locally. There was always a separate assessment for No. 9, the premises to which the Board had supplied water; and up to the time of the revised charges coming into force, the water-rate was on an assessment for this building only. The whole of the premises were held under one lease. It was contended that No. 9 only was liable to assessment for water-rate during the time the supply was given by a communication pipe that went to that house, and that the fact that there was intercommunication with adjoining premises did not render them liable to assessment. His Honour took time to consider his judgment; and it has just been communicated to the parties. It is against the Board; and there will probably be an appeal.

Welsbach Light Company of Australasia, Limited & Reduced.

A petition asking the sanction of the Court to a reduction of the capital of this Company came before Mr. Justice Joyce last Tuesday. Mr. Thompson, who appeared in support of the petition, said the Company carried on a very successful business as dealers in light-fittings, in this country and in Australia and New Zealand. The capital was £35,000, in £1 shares, fully paid; and this being largely in excess of their requirements, it was proposed to return 19s. per share, so that in future the capital would be 35,000 shares of 1s. each. A resolution had been duly passed with this object, and the invested funds were amply sufficient to make the payment. There was a certificate of the debts; the principal creditor being the London and Joint Stock Bank, Limited, who consented to the petition. The other debts amounted to only £195 8s. 9d., to meet which money would be put to a separate account in the bank. His Lordship made the order confirming the resolution.

The South Suburban Gas Company's Water-Rate Case.

Mr. Justice Neville had before him in the Chancery Division of the High Court of Justice, on the 11th inst., a motion to review or vary the minutes of the order made in the action brought by the South Suburban Gas Company against the Metropolitan Water Board in regard to the charge for water supplied to the gas-works, the proceedings in which were reported in the "JOURNAL" for the 19th of October (p. 191). Sir Alfred Cripps, K.C., said he had had an opportunity of conferring with Mr. Danckwerts on the matter, and fortunately they had been able to agree on what they thought would be the right form. It was a declaration that, under and by virtue of sections 8, 9, and 13 of the Metropolitan Water Board (Charges) Act, 1907, the plaintiffs were entitled to be supplied by the defendants with water for domestic purposes as owners and occupiers of the buildings, for the engineers', assistants', directors', and Secretary's lavatories, and for all the various places mentioned in the statement of claim, for the domestic purposes in the parish referred to. But they were not entitled to be supplied for such purposes under section 16 of the Act; and were not entitled to be supplied with water for the heavy and light horse stables otherwise than under that section. Counsel said both sides were anxious to get a decision; and this made it as specific as possible. The order would, he supposed, be dated that day. Mr. Danckwerts agreed, and the order was made accordingly.

Twineham Water Supply.—The Cuckfield Parish Council have resolved to accept the offer of the Public Works Loan Commissioners for a loan of £1216, at 3½ per cent. per annum, for furnishing a water supply to Twineham, for which the consent of the Local Government Board has already been received.

MISCELLANEOUS NEWS.

PRESTATYN GAS TRANSFER ARBITRATION.

First Day's Proceedings.

As was briefly stated in last week's "JOURNAL," an arbitration was held at the Surveyors' Institution on the 6th and 7th inst., to determine the price to be paid by the Prestatyn Urban District Council for the local gas undertaking, which is the property of Lady M'Laren. The Council obtained power to purchase the works under an Act passed in the last session of Parliament (see "JOURNAL" for June 15, p. 735, and June 29, p. 983).

The Arbitrators were Mr. CORBET WOODALL for Lady M'Laren, and Mr. E. H. STEVENSON for the Prestatyn Urban District Council. Sir HUGH OWEN, G.C.B., acted as Umpire.

The Hon. J. D. FITZGERALD, K.C., and Mr. RAYMOND ASQUITH (instructed by Messrs. Sharpe, Pritchard, and Co.) appeared for Lady M'Laren; the Council being represented by Mr. WEDDERBURN, K.C., and Mr. F. N. KEEN (instructed by Messrs. Baker and Co.).

THE CASE FOR LADY M'LAREN.

Mr. FITZGERALD, in opening, said the history of the gas-works extended over seventeen years in point of time. Prestatyn was a small seaside place on the estuary of the Dee; and Mr. Henry Pochin, Lady M'Laren's father, who was possessed of considerable property in the neighbourhood, in 1892 obtained a Provisional Order authorizing him to establish gas-works there. He took this course with the view of assisting in the development of the place, which at that time was so small that no remunerative return could be expected for a considerable period. The Order stated that the limits of supply would be the parishes of Meliden, Cwm, Dyserth, and Newmarket, in the County of Flint. The capital under the Order was not to exceed £5000; and the maximum dividend was to be 10 per cent. Borrowing powers up to £1250 were allowed, the maximum interest payable to be 5 per cent.; and the gas was to be of 15-candle power, with a maximum price of 6s. per 1000 cubic feet. There was a proviso in the Order—"That if the undertaking is at any time assigned to any other body, company, or person, such body, company, or person shall, from the date of such assignment, be the undertakers for the purpose of this Order, in lieu of the person or persons above-mentioned; but no such assignment shall have any validity or effect until after the approval of the Board of Trade to such assignment has been signified in writing signed by a Secretary or an Assistant Secretary of the said Board. Provided that nothing in this Order contained shall prevent the undertakers borrowing money on the security or mortgages of the undertaking not exceeding the amount by this Order prescribed, or shall make the consent or approval of the Board of Trade necessary to the validity or effect of any such mortgage." So far as he knew, this was an ordinary provision inserted in Orders of this description. When the Order was obtained in 1892, Prestatyn was merely a seaside village; and no one would have thought of establishing a gas-works there, unless he had been interested in the locality, like Mr. Pochin was, and felt willing to wait for a considerable period before getting any remunerative return on his investment. That was exactly what had happened in this case. The works were carried on at a loss for the first two years; subsequently for several years there was a nominal profit; and then the profit went on slowly increasing, until during the last two years the undertaking had become remunerative. The population had increased, many new houses had been built, and consequently the consumption of gas was very much greater. It had been stated that in 1901 the population in the gas area was 2400 odd; and that last summer the resident population had increased to 3650, in addition to which there were visitors amounting to between 4000 and 5000 persons. The gas sold for private lighting in 1904 was 2,465,800 cubic feet; while last year it had reached 4,247,100 feet. During the same period, the quantity of gas consumed for public lighting had gone up from 259,300 cubic feet to about 341,000 feet. The amount of increase in the gas sold in the four years was close upon 14 per cent.; and this increase was still going on. There had naturally been a corresponding rise both in the gross and the net income. In 1904, the revenue was £650, and the profit £121; while in 1908 the gross income was £1166, and the net income £418, or between 6 and 7 per cent. on the capital expended on the concern. All this showed the progressive nature of the undertaking; and proved that if it had continued in the hands of Lady M'Laren for a couple of years longer, it would have been paying the maximum dividend allowed under the Order. The existing capital powers having become exhausted last year, Lady M'Laren applied to the Board of Trade for a Provisional Order for further capital, and this was granted; the additional amount being £5000, with borrowing powers to the extent of £1250. Simultaneously with this, the Urban District Council, having become aware, through a communication from Lady M'Laren, that she was applying for a fresh Provisional Order, brought in a Bill to enable them to compulsorily acquire the undertaking. This Bill was passed by Parliament; and, of course, the Provisional Order was thereupon rejected, as having become unnecessary. The Act provided that, failing agreement, the price should be determined by arbitration under the provisions of the Lands Clauses Acts; and the sale and purchase should be deemed to be by compulsion. It was also stipulated that, in addition to the amount to be paid under the arbitration, the Council should pay the sum of £250 towards the costs and expenses incurred by Lady M'Laren in connection with the promotion of the 1909 Order and her opposition to the Council's Bill, so far as such opposition related to the transfer of the undertaking. The Council would take over the undertaking free from liabilities of every kind, and free from all debts on current account; and the Act stated that the vendor should be entitled to all the gas-rents and other debts due to her, and to all receipts from the undertaking, up to the date of transfer. The stock of gas coal and other stores at the date of transfer would, of course, be taken over at an agreed price, or as settled by a valuer. The Act stated that the price to be charged by the Council for gas supplied by meter should not exceed 5s. per 1000 cubic feet; and section 17 read: "The limits of this Act for the supply of gas shall be, and include, the district and the parishes of Meliden and Dyserth, in the County of Flint." For some reason, the Council did not wish to extend their area; but that remained useless to Lady M'Laren. The works were good, solid ones; and the price charged for gas was a reasonable one, below the maximum named in the 1892 Order. What had to be ascertained for the purposes of the arbitration was the net profit of the undertaking at the present moment; and this being a progressive concern, it was, of course, desirable to get the net profit up to the very latest minute. The tables that had been put in and agreed between Messrs. Cash, Stone, and Co., for Lady M'Laren, and Messrs. Keen and Co., acting for the Council, were for the period terminating on Dec. 31 last; and the reason they agreed the tables at this date was that when Messrs. Keen and Co. were asked to go into the figures for this year, of which three-fourths had already expired, they declined to do so—stating that they had been instructed on behalf of the Council not to go into any figures later than Dec. 31 last. Of course, they were bound by their instructions; but the reason why those instructions were given was perfectly obvious. This was a progressive undertaking, in which the consumption of gas and the net revenue were increasing year by year; and if the figures for this year were taken, they would be found to be considerably in excess of those for last year. However, the refusal of Messrs. Keen and Co. to go into the later figures did not in any way preclude these figures from being ascertained; and consequently they had been set out by Messrs. Cash, Stone, and Co. for the three quarters already expired. In every one of these quarters there had been a considerable increase over the consumption in the corresponding quarters of 1908. He thought the figure was 14½ per cent., which was slightly in excess of the progressive figures for the previous year. So as to be quite sure of being on the right side, only 10 per cent. increase had been taken for the Christmas quarter; and working the matter out in this way, they arrived at a profit for the year of £521, as against £418 for the previous year. For capitalization, they had taken 28½ years' purchase, which was about the lowest figure that was asked for in cases of this kind, where a statutory company was being dealt with. In estimating the value of the undertaking, account should be taken of the fact that, if not next year then the year after, the profit would certainly be sufficient to pay the full maximum dividend. The 10 per cent. dividend on the £5000 required £500, and 5 per cent. on the £1250 borrowing powers £62—making a total of £562. Then there was a very large amount outstanding in the shape of back-dividends. The total amount of these back-dividends was £4670; and they reckoned £2477 as the present value of this sum. In round figures, the amounts he had mentioned added together produced a total of £20,000; and in addition there was an allowance for compulsory sale, which was usually taken at 10 per cent., bringing the total of the claim up to £22,000.

Mr. *William Cash*, Chartered Accountant, of the firm of Messrs. Cash, Stone, and Co., examined by Mr. FITZGERALD, said he had examined the undertaking and had made out, in conjunction with Messrs. Keen and Co. an agreed statement, "subject to any question of revision of expenses to maintain the undertaking." This was a note which the Accountants on the other side wished put in, and which was quite proper. The table showed a steady progression in the net balance. In the five years ending 1908, the number of consumers had gone up from 152 to 266. He had also prepared a revenue account for 1909, which Messrs. Keen and Co. had declined to go into with him. The gas actually sold in the first three quarters was 3,527,800 cubic feet, compared with 3,075,600 feet in the corresponding period of 1908. This was an increase of 14½ per cent.; and for the remaining quarter he had estimated an increase of 10 per cent., or a consumption of 1,364,300 cubic feet. His figures brought out a total profit for 1909 of £521; and this table had been prepared as nearly as possible on the same lines as the agreed statement—that was to say, as regarded wages, treatment of stoves, and so forth.

Mr. WEDDERBURN, in cross-examination: I think the date of the notice to treat is somewhere in September, 1909; and you, with your experience, would agree that it is quite usual to take the years—one, two, or three years—preceding the notice to treat?

Witness: Yes; the other plan would be to take it as near as you can to the date of arbitration.

The usual thing is to take the last completed year?—That may be usual; but I do not think you would suggest that it would preclude going into the latest available information.

No; I say the usual thing. This claim may be unusual in many respects. What we have to consider is the value of the undertaking as it stands at the date of the notice to treat?—Quite so.

The table does not take into account, does it, anything additional for spent capital? Have you taken the trouble to ascertain whether during 1909 there has been any further capital expended, though unauthorized?—There was further capital expended, no doubt. I cannot tell you how much.

But that is all-important?—I do not think it is very important.

Assume for the moment that, in order to earn this additional profit, it is necessary to spend (say) £500, £600, or £700. It is all-important, is it not?—No; I think not. Supposing there had been additional expenditure, that does not affect what is to be drawn out.

As we know, it was actually at the end of its tether, and could not go on earning a profit without an expenditure of further capital; and it has overspent the authorized capital in order to be what you call progressive. Then, in order to see what chance there is of being able to make up back-dividends, you must see what the further expenditure has been, and what the return on that will be?—Certainly; but I do not think that affects the right of the undertaker to draw up to the maximum dividend authorized by the Order.

But it affects the possibility of her being able to do so to a very marked degree. Supposing, in order to go on earning what she had been earning, she has to spend a lot of capital. She has to get a return not only on the old capital but on the new; and supposing she has to raise it at (say) 7 per cent., it would handicap her powers in the undertaking?—I agree; but it might be worth while to expend capital and

seek no return on that capital, in order to earn the maximum dividend on authorized capital.

Further cross-examined: The overspent capital was now about £550. In his table, he had taken the rates actually payable. He had not considered the question of leakage. He could not agree that a small undertaking would necessarily not present so good a security as a large one.

Mr. *Henry M'Laren*, a son of Lady M'Laren, examined by Mr. RAYMOND ASQUITH, said he thought some £300 or £400 more than the authorized capital had been spent, in order to bring the works up to a satisfactory condition to meet the growing demands.

Cross-examined by Mr. WEDDERBURN: It was a fact that in some of the M'Laren leases the condition was made that a certain number of gas-burners were put into the houses. They had, however, only let very few houses. Certainly, the owner had this power; and it would be lost to the undertaking by the severance, which to this extent made it a lessened security.

Mr. *Henry Woodall*, of the firm of Messrs. Corbet Woodall and Son, examined by Mr. FITZGERALD, stated that he had been all over the district, and knew the works well. They were in very good order for small works. There was a certain margin at present; but with small capital expenditure, the output could be very materially increased. Within the last few years, the growth of the business had been rapid; and there was every indication of this state of affairs continuing. At the end of 1908 he made a structural valuation of the works; and the total of this came to £6752. The amount shown of capital expended was £6447. The latter figure worked out at £1405 per million cubic feet of gas sold. The unaccounted-for gas in 1908 was 10·95 per cent., which was certainly much higher than it should be. A small expenditure on renewing services would put this right. He would be dissatisfied if he could not reduce the figure to 5 per cent. At present the make per ton was only 9417 cubic feet; and he estimated that if an exhauster were put in, something approaching 11,000 cubic feet could be made. The cost would be £135. This was one of the things he recommended should be done if the new Provisional Order had been obtained and the further capital raised. He would also have reduced the cost of purification ultimately by adding two more purifiers. Then, also, they could have increased the pressure, which was a thing they would have liked to have done. He anticipated that when the actual figures were arrived at in January, it would be found that the increase had been larger than 10 per cent. for the last quarter of this year. In his valuation, he had capitalized the £521 profit arrived at for 1909 by applying the multiple of 28½ years' purchase. It was the lowest figure he had known to be taken in these cases, when dealing with a statutory company. This came to £14,848. To arrive at prospective profits, he had estimated on a 12 per cent. basis for 1910, though the increase had been at the rate of 14 per cent. He took as a basis £100 profit per million cubic feet of gas sold, which gave an additional profit of £62 for 1910. This he multiplied by 28½, and discounted it back one year, making in this way £1700 to add to his valuation. Then he dealt with the next year in the same way—that was, he added £70, multiplied by 28½, and discounted back two years, making £1845—because at the end of that year they would have earned all the dividend they were entitled to. The additional capital expenditure necessary to put the works and mains in a condition to earn the dividend he had estimated at £805. This reduced the total capital value to £17,588. He had ascertained the present value of the £4670 of back-dividends to be £2477. He had prepared a table showing what capital expenditure would be necessary each year, and the profits reckoned on an increase of 12 per cent.; and this indicated that by the year 1920 they would have received in back-dividends £3485, the present value of which was £2477.

Mr. CORBET WOODALL: What fixed the date of 1920?

Witness: The principle of it was to fairly estimate the capital expenditure which would be necessary.

Is any provision made for a reduction in the price of gas in the meantime?—No.

Examination continued: This made his valuation £20,065, to which he had added £2006 (10 per cent) for compulsory purchase—making the total value £22,071. As to the prices charged for gas, he had taken from the Board of Trade returns the particulars of undertakings within a radius of 20 miles; and he found that this concern charged less than any one of the others of the same size. More than one-half of the gas sold at Prestatyn (where differential prices prevailed) was at the rate of 4s. per 1000 cubic feet.

Mr. WEDDERBURN: Can you call my attention to any valuation in another case which follows the lines of yours?

Witness: I have never seen one like it before, because I have never seen an undertaking bought up at such an early period of its existence, before being able to earn profit.

But surely that does not affect the principle on which you are to value it. You do not suggest that there should be different sets of principles on which an undertaking should be valued according as it is bought up in the tenth, or twentieth, or thirtieth year of its existence?—Certainly, I do. There are back-dividends that might be earned.

Whatever figure is taken, ought you not, in the first instance, to deduct any profit on fittings, and then bring it in again, so that you do not multiply them by the factor 28½ years or less, but you multiply them by only five years?—The figure here is very small; and I think it is one that could be maintained. If it were a big figure, I should have done differently.

Cross-examination continued: He could quite conceive the security being very much better in a small undertaking than in the case of a large one. A large undertaking might very well depend upon an industry which might be decaying, or something of that sort. It was perfectly reasonable to put the value that he had put on this one. He did not think 28½ years' purchase was too much to ask; and less had never been asked.

Mr. STEVENSON: Of recent years, do you mean? Because my experience goes back farther than yours; and I have known 20 years asked for on statutory undertakings, and then 25 years.

Mr. FITZGERALD: That was a very long time ago.

Re-examined by Mr. FITZGERALD: So far as he was aware, no objection had ever been taken by the Local Authority to the depth at which the mains were being laid.

Mr. STEVENSON: On what ground do you claim 10 per cent. for compulsory purchase upon prospective profits and back-dividends?

Witness: I take it the Act says we are to have 10 per cent., it being a sale by compulsion; and I take 10 per cent. on the whole thing.

But do not you know that that is absolutely untenable?—No. I have discussed it with several people; and I do not think it is untenable. I think the 10 per cent. might just as fairly be said to come on prospective profits as on the main figure.

And back-dividends?—Yes. You have to value the concern, and say: "Now I want whatever is the right figure for compulsion."

Mr. CORBET WOODALL: Speaking about the question of repairs and maintenance, there has been a very large increase of recent years in the amount spent by the average gas company, has there not?

Witness: Very large. The cause has been very largely the prepayment supplies. Here there are but few prepayment consumers, and they do not supply them with any fittings or stoves.

But apart from the outside business, is there any increase in the amount of expenditure upon repairs and maintenance on the works?—I do not think there has been in works of this size.

I was not referring to that. I was thinking of the average expenditure on works nowadays. Is it larger or not than it was (say) fifteen years ago?—Certainly, because a bigger works uses a large amount of machinery; but in a works of this size there is no machinery.

With regard to stoves, is it a fact that they are nearly all on the hire-purchase system?—They are.

Do you know whether there was any arrangement under which the supplier of these stoves maintains them?—I do not know what arrangement there is.

Mr. FITZGERALD: I understood Mr. Wedderburn to ask for any case where a valuation had taken place in the year in which notice to treat was given. I happen to have here the proceedings in the Chard case, which are as nearly as possible identical with this—that is to say, the Act authorizing the transfer was passed in 1903, and the notice to treat was given, I am informed, in September, 1903; and Mr. E. H. Stevenson, who appeared for the Company, in putting forward their claim, took the profits of the year 1903, both those before and those after the notice to treat, as the basis of his valuation.

Mr. STEVENSON: Yes.

Mr. FITZGERALD: And in doing so, Mr. Stevenson was right.

Mr. STEVENSON: The reason for my doing that, perhaps you may know, was that the Company had built entirely new works; and that was the first year of working with the new works.

Mr. FITZGERALD: That may have been one reason.

Mr. STEVENSON: That was the only reason.

Mr. FITZGERALD: Obviously that cannot make any difference as to the principle—I mean as to the year of the notice to treat.

Mr. WEDDERBURN said that in the Pontefract case Mr. Lankester, who appeared for the Company, admitted that he could not go past the notice to treat. What Mr. Lankester there had to do was this: He said: "I agree you cannot take as the basic figure anything since the notice to treat; but I can use this question of the greater increase in order to show that the basic figure which I shall take is a maintainable figure." This, he submitted, was the true way to do it. That was to say, in the present case they could not change the £418 into £521; but they could point to the £521 to show that the £418 was maintainable.

Mr. FITZGERALD: I know that what I have put forward has been the ordinary practice—and that is that, where a period has elapsed which enables the figures to be given even after the notice to treat, those figures are put before the Arbitrator; and they are taken as the basis for the particular case. Indeed, it was done in the Chard case; and the distinction which Mr. Stevenson has mentioned there cannot affect the question of law or the basis of valuation.

Mr. *Cash* having been re-called to show how certain agreed figures with regard to stoves had been arrived at,

The evidence on behalf of Lady M'Laren was closed.

THE CASE FOR THE COUNCIL.

Evidence in support of the Council was then at once called.

Mr. *Frederick Wilkinson*, Surveyor and Engineer to the Prestatyn Urban District Council, examined by Mr. WEDDERBURN, said he had control of the public lighting; and at the end of last month, he had the roads opened in various places for the purpose of examining the size and condition of the gas-mains. The maximum depth at which he found mains was 2 ft. 3 in.; and the minimum, 6 inches. In regard to the latter case, possibly the top of the road might at some time have been taken off. He had been in office twelve months, and no complaints had been made to him of insufficient pressure.

Cross-examined by Mr. FITZGERALD, witness said he believed all the pressures shown in a table produced were in excess of those in the Provisional Order. He did not give notice to the other side when he opened the streets to look at the mains. He saw no reason why he should communicate with them, as he assumed they knew the depth of their mains.

Mr. CORBET WOODALL: Would it not have been better to give the undertakers notice, because this is more a question on the facts; and because they were giving one fact and a different version was being given by others, see how perplexing it is?

Witness: I assumed they already had this information.

But you were preparing evidence to bring down here; and would it not have been very much better if you had given them this satisfaction? I can never see why there is this disposition to act as if you were enemies, instead of purveyors of truth to the Court?—As a matter of fact, the Engineer has had several of these same holes opened.

Second Day's Proceedings.

Mr. *Joseph Banks*, a member of the Council, examined by Mr. KEEN, said he had complained of "bad gas" and of the street lighting. He had also suffered from the variable pressure of the gas.

Mr. CORBET WOODALL: On what ground do you say the gas is bad?

Witness: It smells abominably at times in the burning; and we have had great difficulty with the taps sticking.

Mr. *W. Brock Keen*, Accountant, examined by Mr. KEEN, said he joined with Messrs. Cash, Stone, and Co. in preparing the agreed

tables. According to these tables, the repairs were less in 1908 than in any of the other four years included. All the items, *plus* depreciation on cookers, for that year came out at 2·09d. per 1000 cubic feet. The highest was 1906—5·02d. Bad debts—0·19d.—were very small; but he did not question this figure, because the Manager (Mr. Linnell) was satisfied the amount would be sufficient to meet all debts that would in fact prove bad. There was included in the revenue account the sum received from consumers who had stoves on hire-purchase. He put this for 1908 at £8 4s. At the rate of repayment the balance, of principal still owing from the hirers would be paid off in a little over three years; and the revenue therefrom ought not to be capitalized at any more than the three years at which it would stop. If it were suggested that other hire-purchase transactions would take place, the reply would be that the undertaking had no further capital to invest in the purchase of stoves to sell again on the hire-purchase principle—the capital being already exhausted. Up to the end of 1907, the whole of the profit was earned by expenditure of capital within the statutory limits; but for 1908 to a small extent the profit was earned by capital expended in excess of the authorized amount. As regarded any question of profit available for the payment of back-dividends, dealt with in Mr. Woodall's valuation, still more must this be earned by capital expenditure in excess of the authorized limits. Mr. Woodall's profit of £521 to be capitalized referred to the year after notice to treat; and according to his (witness's) experience, it was unusual to make the basis of the purchase on this. The last completed year was the time.

Mr. FITZGERALD: In my experience, it is quite the usual practice to take the year in which the notice to treat is given.

Witness (further examined) said there was obviously an objection to take the accounts on an incompleted period, because the item of estimate entered so largely into it. He should start with the £418; but profit on fittings and rental on hire-purchase stoves ought not to be included in this figure and dealt with on the one principle. An adjustment ought to be made, too, in regard to the charge for repairs and maintenance, and for rates. He could not understand the insertion of Mr. Woodall's item of prospective profits.

Mr. KEEN: Mr. Woodall having taken the figure of £521 and capitalized it at 28½ years' purchase, and taken the prospective profits at £62 multiplied by 28½ years and discounted back one year, and £70 multiplied by 28½ years and discounted back two years, you think he is over-estimating the increase of profit for 1910 and 1911?

Witness: Yes. The first thing that attracts my attention is that even at the time £62 carries the matter beyond the maximum profit. Adding the £62 to the £521 makes £583. The maximum dividend and interest is £562 10s. Adding on the next figure of £70 makes a total of £653, or £91 in excess of the authorized amount.

What is the effect of taking the addition and capitalizing it?—You are capitalizing the future profits anticipated to result from the capital and energy of the purchaser; and I suggest this has nothing to do with the undertaking that is being sold. You must buy an undertaking as it is.

You are dealing with an undertaking in the hands of the vendor at the time of the notice to treat?—Yes. If not, why stop at these two years—why not go on indefinitely?

As regards the excess of £91 over the statutory dividends, what relation has it to the question of back-dividends which he deals with later on?—That is the profit which, if earned, will be applied to pay the back-dividends; and therefore if any claim for back-dividends were made, a larger claim for profit is capitalized out of which the back-dividend is going to be paid.

Then he is really claiming the back-dividend twice over?—Obviously, in the item of prospective profits and in the item of £2477 which he adds.

Mr. CORBET WOODALL: Does that apply to the prospective profits altogether?

Witness: I think it applies to the prospective profits as a whole.

Mr. KEEN: Is this question of back-dividends really only dealt with twice or three times?

Witness: I think it is dealt with three times. I take it that it enters into the number of years by which you capitalize the maintainable profits. It goes to the question of security.

In your opinion, can any item of back-dividends be properly claimed in any case other than where a company is earning its maximum dividend?—No; I think it is only a proper claim where the company is at the time of the purchase earning a profit which is in excess of its maximum dividend. Then it has these profits actually at the time of the purchase accruing, out of which, if it is left alone, the back-dividends would be paid. This, I think, is really the circumstance that justifies a claim for back-dividends. Otherwise, it is a claim for back-dividends payable out of the profits which the purchaser is going to make as the result of his capital and his energy.

In your opinion, can the undertaking as it exists to-day have any future value, if you apply the proper multiplier?—No; I think not.

And so far as your experience goes, is that the accepted principle of valuing an undertaking which is not earning and paying its maximum dividend?—Yes.

Mr. FITZGERALD (in cross-examination): You would not, of course, make any payment in respect of back-dividends till the maximum dividend has been more than earned. Supposing in the year or at the time the notice to treat was given the full dividend had been earned, and that it was a progressive undertaking in which for a number of years profits had increased every year, and were likely to continue in future, do you contend that the Arbitrators should not take into account the question whether, if the concern had remained in the hands of the existing undertakers, they would not have been able to earn back-dividends?

Witness: I think the Arbitrators can take into account the ability to earn back-dividends out of the excess of profit earned at the time of purchase beyond the maximum dividend; but only to that extent.

But supposing at the time of purchase the maximum dividends were earned, and there was no substantial excess; but owing to the nature of the company there had been an increase in income for the year, and this increase was likely to continue, so that the back-dividends were likely to be able to be paid, do you suggest that the Arbitrators would not be entitled to take that into account?—Certainly not.

Mr. FITZGERALD: Is it not a fact that in the North Warwickshire Water case (when you gave evidence) the claim for compensation was entirely in respect of prospective profits, when the Company were earning no profits?

Mr. WEDDERBURN: My recollection is that there was a special enactment in the North Warwickshire case enabling them to claim prospective profits up to ten years; and without that enactment, you could not claim it.

Mr. FITZGERALD: It was only based on the growth of the district and prospective profits?

Witness: For the ten years limited by the Act.

The proviso in the Act limited the amount of claim for prospective profits; it did not authorize it?—I do not think we should have been entitled to claim at all but for that clause.

Your case is that the Arbitrators are entitled to take into account existing profits, and not to be allowed to consider that the owner would make a bigger profit if he continued owner?—They are entitled to do that by the number of years' purchase. In no other way would they be entitled to do so.

Evidence has been given that the amount of the assessment is about 1d. per 1000 cubic feet. If you take all the cases given in "Field's Analysis" for provincial towns the average is 1·18d. per 1000 cubic feet?—That does not assist me in arriving at the rateable value.

What you have to say with regard to repairs and maintenance is that the undertaking is in good repair, is it not?—That the expenditure is sufficient to keep the undertaking in good repair.

And if the expenditure is sufficient to keep the undertaking in good repair, it does not matter in the least whether it is 4d., 5d., or 6d. per 1000 cubic feet?—Yes. In dealing with the profits of any particular year, you should not necessarily assume that the money spent during that year represents the charge on the undertaking in respect of the year. There is such a thing as a renewal fund which always comes into these calculations, and which has the effect of equalizing the expenditure over a series of years. Supposing the whole of the repairs during the five years included in the tables were done in 1907, and there had been no expenditure in 1908, it would not be fair to say that the profit of 1908 accurately represented the profits of the undertaking.

Re-examined by Mr. KEEN, witness said in the North Warwickshire case there was no profit to be capitalized by a multiplier, which showed that the case was altogether exceptional. It was an agreed bargain between the Corporation and the Company.

Mr. *Sidney E. Stevenson*, examined by Mr. WEDDERBURN, said he had visited the Prestatyn works, and had come to the conclusion that they were just about of sufficient capacity to maintain the supply of the quantity of gas at present required. There was one exception—the scrubber, which was far too small. He had made a valuation, starting with £418, the profit shown by the balance-sheet of the last completed year before the notice to treat. From this he deducted the profit on fittings, £5, in order that it might not be multiplied by the full number of years. As to repairs and maintenance, &c., it was agreed that the accounts showed 2·09d. per 1000 cubic feet; and to this he had added 0 3d. for labour. The work was practically all done by outside firms, and labour was included in it. Therefore he allowed no extra labour on maintenance of works. On maintenance of mains, &c., there would, however, be some labour. Taking year in and year out, he thought 6½d. would be a fair sum for repairs and maintenance. He therefore added £78 11s. As to rates, a re-assessment of the works should take place at once, in which case he thought the assessment would work out at 2d. per 1000 cubic feet of gas sold; so that he would have to practically double the present assessment, adding £19 2s. Thus he arrived at a maintainable profit of £315 7s. He took 20 years' purchase—making £6307. Adding £15 for three years' profits on fittings, the total was £6322. The undertaking could not grow without the expenditure of further capital. He agreed with Mr. Keen that, on the question of prospective profits, they could only take these into account when they came to consider by what number of years they should multiply the basis figure of £315. He had given effect to this in fixing upon 20 years. Profit on fittings he multiplied by three years, because it was open to every kind of competition. He made a deduction of £656, for the cost of lowering mains to 2 ft. 6 in., as he understood that three-fourths of them required to be so treated. This work would result in a saving of leakage, for which he had allowed a sum of £220. Deducting £140 in respect of hire-purchase of stoves, made his final valuation £5746, apart from any allowance for cost of re-investment.

Mr. FITZGERALD (in cross-examination): Do you observe that the result of your valuation is that these works, having been established seventeen years, and having now got into a paying and prosperous condition, are not worth the money expended on them?

Witness: That is my opinion. I think they are heavily over-capitalized.

As I understand, you did not look into the figures for 1909 at all?—No.

With your knowledge of gas-works, and knowing that this undertaking has been increasing, both in the sale of gas and in the profit, every year, do you mean to suggest here that in the present year (1909) the profits will not be larger than they were in 1908?—I am afraid I cannot go into 1909 at all.

You say that in a small undertaking the risk of breakdowns would be more serious in character than in a large one?—I might put it that the risk of breakdowns is always in existence in retort-settings. In my experience, I have never passed a winter without one or more retort-settings failing.

That is apparently one of your reasons for reducing the number of years' purchase to 20?—It is one of my reasons.

Then if you were told, as the fact is, that these works have been in existence seventeen years, and there has never been a breakdown of the character you describe, would not that influence your mind?—No. Breakdowns always come unexpectedly. I agree that this is all good, solid plant, except the scrubber, for the present make of gas.

Re-examined by Mr. WEDDERBURN: The capital expended per 1000 cubic feet of gas sold was about £1400. This was a large figure.

This completed the evidence.

Mr. FITZGERALD then put in some revised figures in connection with Mr. Woodall's valuation. The calculation for prospective profits was reduced from £1700 and £1845 in the original valuation to a sum of

£1124—reckoning the prospective profits at £41 per annum. This involved the correction of the sum of £805 under capital expenditure to £625. The £17,588 thus became £15,347. The £2477 for back-dividends he proposed to leave as it was. Thus the £20,065 became £17,824; and the total valuation, adding the 10 per cent. for compulsory purchase, became £19,606.

Mr. WEDDERBURN said the question that had to be decided was one which in its nature they were all agreed upon—the value of the undertaking to be transferred. The difference of principle that arose was when they came to consider at what period they were to assess the undertaking. He submitted that the notice to treat had always been regarded as the contract. The moment the notice to treat was given, a date was fixed; and what had happened before that, and what had happened after that, were facts which assumed very different importance. What they had to look at was the value of the thing to be sold in the hands of the owner at the date at which it was contracted to be bought—namely, at the date of the notice to treat. The two views put forward were widely different as to its value. They were, of course, the views in the two valuations, which, after all, were now the only two documents of importance in the case, because everything one had to say could be hung on the one or the other of them. There was only one observation he had to make independently of these two documents. When Mr. Fitzgerald was opening, he asked him to read a particular section of the Provisional Order, which said that the undertaking could not be transferred without the assent of the Board of Trade. He desired the Court to take note of this, because, though it was not a very large point, it was still a point when one came to consider what the value of the undertaking was. It could not be bought and sold quite in the ordinary way. It could not be disposed of by the vender to any person without the assent of the Board of Trade being obtained; and this must to some extent affect its market value. There was no doubt the two main figures at which the Court had to arrive were the annual profit (which was a question of fact); and then the factor by which this was to be multiplied (which was a question of maintainability. Mr. Woodall's valuation was in a totally unprecedented form; and it was a remarkable state of things. Mr. Woodall's table referred entirely to the figure of £521, with the result that he started with an amount which was largely based upon an estimate. He (the learned Counsel) contended that all material after the notice to treat was only applicable to show that the ascertained figure up to the date of the notice to treat was a maintainable figure. They could not go beyond the date of the contract, and take a prospective figure, to be multiplied then by the same number of years as they would do with the actual figure. On principle, therefore, he asked the Court to discard the £521, and adopt the £418. Then Mr. Woodall's figure for prospective profits was brought in upon a false principle. These profits were not the owners' to sell at the present moment. They could never be obtained without the purchasers' capital and labour; and they were altogether speculative. What they had to look at was the amount which could be realized under the existing conditions at the date of the contract—namely, at the date of the notice to treat. His argument was that prospective profits were outside their purview. In answer to this, Mr. Fitzgerald quoted the North Warwickshire case. That was a Water Company started in the neighbourhood of Coventry in 1898. They had as part of their district an area which the Coventry Corporation thought would soon be included in their own boundaries; and consequently the Corporation said they would oppose the granting of this area to the Company. Therefore a bargain was come to between the parties, that the Company, when the Corporation secured the area by extension and came to turn them out, should be entitled to only ten years of prospective profits. Therefore the North Warwickshire case was a peculiar one. Mr. Woodall admitted that with the existing authorized capital they could not exceed the £418 profit, subject to deductions; and so the Council said that this £418 was the proper figure. The same thing applied exactly to the back-dividends. If it was admitted that on the existing capital they could only earn £418, of course they never could pay any back-dividends at all. In the revised table, Mr. Fitzgerald seemed to think fit still to keep in a claim for 10 per cent. both on prospective profits and on back-dividends; but this was absurd. As regarded the 10 per cent. itself, the Court were not bound to give it at all. The only figure they had to give—and he admitted they would give something, it might be 1½ or 2 per cent.—was for the cost of re-investment, and possibly for the loss of interest between getting the money and re-investing it. Think what it would mean if they were to burden a small town like Prestatyn with £20,000 as the price of an undertaking which was yielding only £418 unadjusted. Then when they came to adjustments, they would see that the figure was only £315, and that it was an undertaking which, in order to yield the £418, had had to overspend its capital. In addition, it was in a district which was not developing as rapidly as might be expected. Coming to Mr. Sidney Stevenson's valuation, there was no doubt that his £418 was a right figure, because it was agreed. He submitted that he was also right in deducting the £5 as a figure not to be multiplied by the number of years; so that the £413 was right. He was also right, because it was an agreed figure, in saying that 2·09d. per 1000 cubic feet was what the accounts showed as the amount put to repairs and maintenance and depreciation; and he had added, under circumstances he explained, 0·3d. for labour. Therefore it had to be admitted that, so far as one could gather, the amount shown in the accounts was much below the 6½d. which experience indicated to be necessary averaged over a number of years. Thus something more had to be deducted from the £413; and, accepting the figure of 0·3d., £78 11s. correctly represented the deficiency. As to rating, it was absurd to suppose that the present assessment was going to remain; and they contended that the true figure would come to about 2d. per 1000 cubic feet. Deducting the result of these amendments, they arrived at £315, which he said was the figure that had to be multiplied by some number of years' purchase. As to the multiplier, 20 years represented a 5 per cent. basis; and he asked the Court to accept this as fair. With reference to the lowering of the mains, it could not be supposed that the Council were going to leave the mains which were (beyond dispute) improperly laid—such as those at depths of 6 inches, 9 inches, and 15 inches. It was calculated that about 75 per cent. of them would have to be relaid. But allowance in the cost of this would, of course, have to be made for the reduction in leakage which would ensue. The hire-purchase stoves could not come in on the 20 years' basis; and a deduction would have to be made in this respect. The only other matter, he had already referred to—the amount to be allowed for re-investment. He asked the tribunal not for an instant to think of giving 10 per cent. He submitted nobody had ever heard of 10 per cent. being given in a gas case, where there was no question of inconvenience or sentiment, but merely of business. Of course, something extra ought to be given.

Mr. FITZGERALD, in reply, said he agreed that they had got to ascertain the value of the undertaking as at the date of the notice to treat; but it was the value of the concern then with all its potentialities and possibilities. Mr. Wedderburn's conclusion that they were not to consider what the earnings were in the year when the notice to treat was given, was, he ventured to say, opposed to the experience of every person who had practised in this class of case, and had only to be stated in order that the absurdity of the proposition might be seen. The basis of the compensation was the value to the person who was compelled to sell; and though they were to ascertain the value of the undertaking at the date of the notice to treat, they were gravely told that they were not to take into account the profit which was actually being earned at that date, and must refer back to a previous year. The strongest and the best evidence that could possibly be given now was the amount of profit which the undertaking was earning actually at the time. It was immaterial that Lady M'Laren received from the concern £418 in 1908, if they came to the conclusion that in 1910 she would have earned nothing. It was altogether the profits that were going to be earned which constituted the value of a commercial undertaking, and the profits that had been earned were looked at for the purpose of ascertaining what the future profits would be. He complained very much that, when the Bill was in Parliament, the case put before the Committee to induce them to allow Lady M'Laren to be compulsorily expropriated was that she would lose nothing by the transfer, and would get an allowance for prospective profits; and when the matter came to arbitration, there was a complete change of front, and they were told on behalf of the Council that they could not go into the question of prospective profits at all. It had been said that Mr. Woodall's method of valuation was unprecedented, and that no claim of this kind had ever before been made. In the Dundalk gas transfer in 1887, exactly the same thing was done for the promoters as had been done here. The notice to treat having been served in a particular year, and the arbitration being held in the spring just after the expiration of that year, they took as the basis of their calculation the profits earned in the year in which the notice to treat was served. Where the circumstances admitted of it, it was done as a matter of course. In the Chard case, exactly the same thing was done. Mr. E. H. Stevenson had stated that why it was done there was because the works had been remodelled, and that was the first complete year afterwards. This might be an excellent reason for taking that year, but it could not affect the principle at all as to whether or not it was right to do it. Then there was the North Warwickshire case, to which Mr. Wedderburn had referred. There was a restricting clause there which limited allowance for prospective value to ten years. This was not an enabling, but a restricting, clause; and if it had not been inserted, the Company could have claimed prospective profits for 20 or 30 years, if they could have proved them. That was a case in which, with the exception of some mains, no works at all were taken over. On what basis could it possibly be put that a claim for prospective profits was not to be entertained? The prospect a company had of earning further profits added enormously to the value. If the concern had been acquired when it was earning nothing, he supposed it would have been argued that they should give nothing for compensation.

Mr. KEEN: No; that is clearly not the point put on this side. The point was that when you got a profit which you capitalized by multiplying, you were entitled to take the prospective profits into consideration in the multiplier. In the case of no profits, as with the North Warwickshire Company, you took this into consideration.

Mr. FITZGERALD (continuing) said that, in view of what he had put forward, he asked that the basis of the award should be the year 1909, which was now practically completed. Therefore the sum of £521 being the basis of the calculation, the next question was the number of years' purchase. Mr. Woodall had stated that, in taking 28½ years, he had adopted the lowest figure he could find that had been asked in any recent arbitration where a gas undertaking had been compulsorily transferred. Mr. Stevenson, on the other hand, took 20 years, which he (Counsel) thought would be a very unreasonable figure indeed. It was endeavoured to make out that 20 years was a reasonable figure by diving into Stock Exchange lists and showing in the "JOURNAL OF GAS LIGHTING," or some other paper, quotations of prices in respect of particular companies' shares which varied from 20 to 25 years' purchase of the dividend. Quotations of this sort were not, of course, evidence at all; and they were often merely nominal. Besides, they could not purchase the whole of an undertaking in the stock market. A person like Lady M'Laren, who owned the whole of the undertaking, was in such a position that, if anyone wanted to buy from her, they must pay a much larger price than they would for a small lot of shares on the Stock Exchange. Taking Mr. Stevenson's valuation, he would refer first to the deduction of profit on fittings. This was a commercial undertaking; and part of its business was to sell these fittings; and the sum which they earned in this particular year was £5. In the next year, it was still larger. There did not seem any reason why they should not apply the same number of years' purchase to the portion of the income that was derived from the sale of fittings as was applied to the portion of the income which was derived from the sale of gas. He knew, however, that what Mr. Stevenson wished them to do had been done in certain cases; but there really was no reason for treating the profit from the sale of fittings on a different basis from any other part of the business, if they came to the conclusion (and there did not seem to be any justification for not coming to this conclusion in the present instance) that, so long as the undertaking went on in Lady M'Laren's hands, she would derive this income from selling the fittings. As to the £78 11s. which Mr. Stevenson took from the profit because he said 6½d. per 1000 cubic feet ought to be allowed for repairs, it should be pointed out that here the staff consisted of a foreman and an assistant;

and there was also Mr. Linnell, the Estate Agent, who gave part of his time to the management of the works, and his son, who acted as Clerk and Secretary. It was inevitable in a works of this character that the repairs from time to time should be done to a large extent by the ordinary staff, and that there were no additional wages to be paid in respect of it. The facts showed that the works were in good order; and no rule of the kind laid down by Mr. Stevenson could apply to an undertaking of this sort. Then his deduction of £19 2s. on the ground that the works were not sufficiently rated was a most audacious proposition. There was a Rating Authority; and they had not raised the valuation. But if they did so hereafter, it would be a deduction from the increased profit to be made hereafter, which, according to the Council, was not to be taken into account at all. Then as to the deduction of £650 for lowering the mains, why should this be made? The mains were laid seventeen years ago at a depth quite sufficient for the ordinary traffic. If now there was a steam-roller, the person using it became liable. No evidence had been given that any fractures had taken place.

Mr. KEEN: Our case is that they are not laid at the right depth; and my friend controverts that by saying there has never been a fracture. We put our case on general principles, and say that 6 inches is not a proper depth at which to lay mains.

Mr. FITZGERALD: There is no such general principle. The general principle is as I have said; and it was decided in the well-known case some years ago of the *Gaslight and Coke Company v. Vestry of St. Mary Abbotts*.

Mr. KEEN: We have evidence that 6 inches is not the proper depth.

Mr. FITZGERALD: There is no such thing as the right depth. If you want to say it is not right, you have to show that damage occurred; and you have not done so.

Mr. KEEN pointed out that the Surveyor had stated that at certain spots the ground was permeated with gas.

Mr. FITZGERALD (continuing) said, in his long experience of such cases, this was the first time that he had heard such a suggestion as that a gas undertaking on being taken over should have all its mains relaid at a lower depth, and that a deduction from the price should be made on that account. Of one thing they might be perfectly certain—and that was that the Council, when they got this undertaking, would never spend £650 for the purpose of relaying the mains. Just imagine them spending £650 for the purpose of making a saving of £11 a year—which, according to Mr. Stevenson, was the total saving that would be made. The fact was that the leakage was too high, and ought to be reduced to 5 or 6 per cent. As Mr. Woodall had told them, however, this leakage arose from the services, and not from the mains; and it could be remedied at quite a moderate expenditure, with the result that the returns would be increased. With regard to the deduction off rental of hire-purchase stoves, the same remarks applied as to the sale of fittings. As to Mr. Woodall's valuation, was there any reasonable doubt that in the year 1910 the profit earned would be at the very least £41 more than that for 1909? If so, this profit, as prospective profit, had to be treated in exactly the same way as the income earned this year—that was to say, capitalized on the same basis, but discounted back one year, making a figure of £1124. Then for the purpose of carrying on the undertaking through next year it would be necessary to spend £625, which Mr. Woodall had deducted. The only other points were as to the back-dividends and the 10 per cent. for compulsory purchase. It had been said that the back-dividends could not be taken into account; but he did not know why. In the London Water Arbitration cases, where back-dividends existed, they were all of them claimed.

Mr. KEEN: Were not maximum dividends being earned there?

Mr. FITZGERALD: In some cases they were, and in some they were not. The contest there turned, as it does properly turn, on whether the history of the Company showed in the past that these dividends would be earned in the future. If you come to the conclusion that the income from this undertaking would not increase, and accordingly that no maximum dividend stage would ever be reached, then, of course, my claim for back-dividends goes. But if you come, as I think you ought, to the conclusion that in a progressive undertaking of this kind the back-dividends would, within the number of years mentioned by Mr. Woodall in his table—that is, up to the year 1920—have been paid to the extent of £3000 odd, and that the present value of those is £2477, this amount ought to be allowed. Continuing, he remarked that it was also said they could not take back-dividends into account because further expenditure of capital was required, and Lady M'Laren had no power to spend it; but this, again, was a misconception of the position. It was an invariable practice of Parliament from time to time to give sufficient capital powers to enable an undertaking to supply gas to its district. In conclusion, he argued that the ordinary 10 per cent. for compulsory purchase should be allowed, and that it should be allowed on the full purchase money of the undertaking.

This brought the proceedings to a close.

New South Wales Coal Strike and the Sydney Gas Supply.—According to a telegram which reached England through Reuter's Agency last Thursday, owing to the North Shore (Sydney) Gas Company being unable to purchase coal, it was feared that the supply of gas would cease at the end of the week. The Railway Companies, however, managed to provide them with coal, and the failure was happily averted.

The New Issue of Brentford Gas Stock.—Tenders were opened last Wednesday for the £30,000 of new stock (1881) of the Brentford Gas Company which were recently invited in our advertisement columns. The applications received amounted to £66,805; the prices offered ranging from the minimum (£180 per £100) to £195 5s. Tenders at £184 (the lowest accepted) will receive about 41 per cent. of the amount applied for.

Bilston Gas Company.—At the annual general meeting of this Company on the 3rd prox., the Directors will report that, after paying the usual interim dividends, there is a credit balance of £8766 on the profit and loss account for the year ended the 30th of September. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares and 4s. per share on the "B" shares (making with the interim dividends 11s. and 8s. per share respectively for the year), and leaving a balance of £6081 to be carried forward.

THE KIRKCALDY GAS TRANSFER.

Important Statement by the Town Clerk.

On Friday evening, a meeting of the Gas Committee of the Kirkcaldy Town Council was held in the Magistrates' Room, in connection with the petition by objectors to the purchase of the gas undertaking, asking that a plebiscite be taken as to whether or not the purchase should be made.

Mr. W. L. MACINDOE (Town Clerk) made the following statement in connection with the question.

When the burgh of Dunfermline was adopting the Gas Act, they took the opinion of Mr. J. B. Balfour, afterwards the Lord President of the Court of Session, as to the manner in which a poll should be taken. The Gas Act says that the poll is to be taken in the manner prescribed by the Police Act of 1862. The Police Act of 1862 was repealed by the Police Act of 1892; and a question therefore arises as to how the poll is to be taken. The opinion given by Mr. Balfour was clear and distinct. He advised that there was no doubt that the poll must be taken under the old rules of the Police Act of 1862—that is, by open voting, the voters being male occupiers of land of the value of £4 and upwards. Mr. Balfour laid down that the general rule is that, where the provisions of one Statute are incorporated by reference in another, and the earlier Statute is afterwards repealed, the provisions so incorporated continue in force in so far as they form part of the later enactment.

I got this opinion from the Town Clerk of Dunfermline in 1897, when the deputation from Kirkcaldy visited that town; and I have kept the opinion beside me ever since, with the view of using it when the time came. I have examined the opinion several times, in the hope of finding some way of escape from the result it lays down. It was not, however, till I returned from London the other day that, on examining the opinion once more with the view of taking the final steps for a poll, it occurred to me where to look for a way of escape from its result. I now find that the statement laid before Mr. Balfour is radically defective. The statement told Mr. Balfour that the Burgh Police Act of 1892 contains no provision for a poll of householders being taken. It omitted to tell him that the Burgh Police (Scotland) Act, 1893, which falls to be read along with the Act of 1892, does contain a provision for a poll of householders. The statement also told Mr. Balfour that the Police Act of 1862 was repealed by the Police Act of 1892 except to such extent as it was incorporated by reference in local Police Acts. This statement is a quotation from section 6 of the 1892 Act. Mr. Balfour was not referred to section 5 of the same Act, which provides that the Act shall supersede, and come in place of, the general or local Police Acts; and, most important of all, Mr. Balfour was not referred to the provisions of an Act called the Interpretation Act, 1889—being an Act for consolidating enactments relating to the construction of Acts of Parliament for further shortening the language used in Acts of Parliament. This Act, among other things, contains new general rules of construction; and the 38th section runs as follows:—

> Where this Act or any Act passed after the commencement of this Act repeals and re-enacts with or without any modification any provisions of a former Act, references in any other Act to the provisions so repealed shall, unless the contrary intention appears, be construed as references to the provisions so re-enacted.

This new rule of construction to a large extent sets aside the main doctrine upon which Mr. Balfour's opinion was founded. The reference given by Mr. Balfour for his opinion is the classic work by Maxwell on "Interpretation of Statutes;" but that book is dated 1875, whereas the Interpretation Act was in 1889. It may seem a little strange that an eminent lawyer like Mr. Balfour should not have known of the Interpretation Act. It only shows how fallible lawyers are. I may say that many other people besides myself seemed to have believed that Mr. Balfour's opinion was correct, because for some years the Convention of Burghs has been endeavouring to get a new Bill passed to rectify the supposed defects of the Burgh Gas Act in regard to the matter of a poll. I have ascertained that opinion has also been given by the present Lord Advocate to the effect that, notwithstanding the repeal of the 1862 Act, the manner of poll prescribed in that Act has still to be followed. This, of course, is the same opinion as that given by Mr. Balfour; and it appears to be equally erroneous. The Scottish Office seem to have accepted as correct the opinions of the late Mr. Balfour and the present Lord-Advocate, and they actually proposed and promised to introduce into Parliament next session a Bill to remedy this supposed defect.

With the new light that has now come to me, I have no hesitation in advising the Committee that the poll falls to be taken in the manner prescribed in the Police Act of 1893—that is to say, by ballot. The voters under this Act are substantially the same as the voters for the municipal election; the only difference being that non-resident proprietors and lodgers do not have a vote. I have just ascertained that the Burghs of Carnoustie and Monifieth took polls as I recommend under the 1893 Act, and that no questions were raised. I have prepared and submit herewith a proof of a bill ordering a poll; and it is for the Committee to say on what day they wish the poll taken.

I take this opportunity of mentioning another matter in which to a certain extent I appear to have been wrong in an opinion I previously expressed. In a statement which I made to the Town Council in 1897, and which was recently reprinted, I said that I thought the purchase price of the Dunfermline undertaking had been about 28 years' purchase of the maintainable profit. This opinion was founded on calculations which, after considering the evidence in the Dunfermline case, I thought was a probable guess as to how the result was arrived at. The result I brought out was a purchase price of £91,000. I thought at the time, and, indeed, till quite recently, that this figure was a fairly accurate guess. On more careful examination, I find that there is an error in the figure. My guesses, if correct, should have brought out a result of £80,000. There was a mortgage of about £11,000 on the Dunfermline gas undertaking; and I thought that my old guess was correct, and that the £11,000 had got to be deducted from the £91,000, making the £80,000. On more careful examination, I have now found that the interest on the £11,000 mortgage was deducted from the

maintainable profit, and that my calculations, if they had been correct, should have brought out the figure of £80,000, and not £91,000. The figures are simply guesses as to how the Arbitrators arrived at their result. The guesses seem to be fairly probable; but no one can pretend to say exactly how the result was reached.

In the belief that my old calculation was correct, I mentioned in my report the figures of 28 years' purchase. This figure, you will easily see from my calculations, arises from taking 26 years' purchase, and adding thereto 10 per cent. For simplicity, I merely added the two together and made 28. In my corrected calculation, it will be seen that the figure is simply 26 years' purchase; and that there is no allowance of 10 per cent. for supposed compulsory purchase, nor any allowance for expenses for winding up.

My opinion as a lawyer is that a gas company in Scotland whose works are acquired under the Burgh Gas Supply Act are not entitled to any 10 per cent. allowance for compulsory purchase. There is a popular misunderstanding about this 10 per cent. allowance. It is commonly supposed that the Lands Clauses Act prescribes that a landowner is to get 10 per cent. for compulsory purchase. There is no such provision whatever in the Lands Clauses Act. It has been the practice, however, of Arbitrators under the Act to allow 10 per cent. for compulsory purchase in the case of houses and building land. In the case of arable land, the practice has been to allow about 45 years' purchase, as against 30 years' purchase for an ordinary sale. There is nothing whatever in the Act as to either the 45 years' purchase or 10 per cent. additional. Both these figures have arisen simply from the practice of Arbitrators. There is another popular misunderstanding. The Lands Clauses Act does not contain powers of compulsory purchase. It simply contains a code as to how compulsory powers contained in another Act—namely, the particular Private Act for the undertaking—are to be applied. The compulsion, in fact, exists in the Private Act, whereby somebody is authorized to take his neighbour's land, and not in the Lands Clauses Act itself. A Private Act containing compulsion runs as follows: "The undertakers may enter upon, take, and use the lands delineated on the deposited plans."

There is no option conferred upon the owners of the lands to decline to sell. They are compelled to sell. Compare this language—that "the undertakers may enter upon, take, and use"—with the language contained in the Burgh Gas Supply Act. This Act provides that the Corporation shall give notice to the Company that they are willing to buy or treat for the purchase of the undertaking; and that if the Company shall consent to sell the same, the Corporation shall purchase the undertaking on terms mutually agreed upon, or to be fixed by arbitration in the manner provided by the Lands Clauses Act. There is not one word in this language to suggest compulsion. It expressly says that the sale is only to take place if the Company shall consent. It is true that the Lands Clauses Act is referred to; but this is only for the purpose of specifying the manner in which an arbitration is to be conducted, and, as I have explained, there is nothing in the Lands Clauses Act about compulsion.

The argument by which it was attempted in the Dunfermline case to claim the 10 per cent., was that the threat of competition by the Corporation must be regarded as the equivalent of compulsion. I think this argument is totally unsound, and that there is no justification for an Arbitrator allowing 10 per cent. for compulsion in an arbitration under the Burgh Gas Supply Act. As I have explained, the 10 per cent. for compulsion has arisen in certain cases in the purchase of land, because it has been the practice of Arbitrators generally in regard to land. No such practice can be alleged in regard to arbitrations under the Burgh Gas Supply Act. Altogether, there have only been two or three cases under this Act; and even if 10 per cent. had been allowed in these cases, it could not possibly constitute a practice.

In England, there is no General Act authorizing the purchase of gas-works; and therefore no general practice in England can be founded on to explain the General Act in Scotland. I am clear, therefore, that, if I was an Arbitrator, I would allow no 10 per cent. for compulsion in the case of purchase under the Burgh Gas Supply Act. For similar reasons, I would make no allowance for the expenses of winding-up the Company. The Company voluntarily chooses to sell its undertaking; and there is no reason why it should not pay out of the price its winding-up expenses.

I am pretty well satisfied, therefore, that the Arbitrators in Dunfermline did not allow 10 per cent. for compulsory purchase, and that the number of years' purchase of the maintainable profit which they did allow was about 26. My report twelve years ago was therefore mistaken, in that I said that the probable price was 28 years' purchase; while I should have said that the probable price was 26 years.

It does not at all follow that, because I said twelve years ago the probable price was 28 years' purchase, or, as I now think I should have said, 26 years' purchase, that this is what I think is the probable or proper price to-day. Twelve years ago all securities were at their very highest. Consols were 113; and 4 per cent. railway debenture stocks were about 160. To-day the corresponding prices are: Consols, 83; railway debenture stocks, about 110. In my opinion, a similar fall in value has taken place in almost all other securities yielding fixed or comparatively fixed rates of interest. My view to-day, therefore, is that 22½ years' purchase of the maintainable profit of a gas company, and not 28, nor even 26, is a probable price.

In former times—that is, prior to 1896—the purchase price of gas undertakings, like the prices of other securities, had been constantly rising. The year 1896 was the highest summit for the prices of all securities; and since that year the prices of almost all have been steadily declining. I see no reason why the price of gas undertakings should not follow those of other securities in falling, in the same manner that they followed them in rising.

As I explained in my original report, there are other elements for consideration besides the number of years' purchase of the maintainable profit. I do not enter into these details just now. I merely desire to correct the error in the main calculation which I made twelve years ago, and at the same time to explain what are my views as to the corresponding figure nowadays.

In my letter to Treasurer Kilgour, dated July 26, 1907, I stated that I was confident that one way or the other the gas undertaking, if purchased, could be financed by the town without any call upon the rates. I am prepared to go further, and to say that it is my opinion that, if the town purchases the gas undertaking, the result will be that, so far from having to make any call upon the rates, or to raise the price of gas, they will be able to lower the price of gas, rather than have to raise it.

It was arranged that the voting for or against the purchase should take place on Wednesday, Jan. 12.

TICEHURST WATER AND GAS COMPANY'S AFFAIRS.

The Old Directors Censured—New Directors Appointed.

An Adjourned Meeting of the shareholders of the Ticehurst and District Water and Gas Company was held last Tuesday, at the Institute of Chartered Accountants, Moorgate Place, E.C., for the purpose of receiving the report on the Company's financial position ordered at the previous meeting (see *ante*, p. 554).

Mr. W. B. MARTIN (the Chairman of the Company) presided, and without any preliminary remarks called upon Mr. C. Ryland Beeby, the Receiver for the Debenture Holders, to submit his report.

The report opened with the statement that the arrangement for the acquisition of the undertaking was carried out with Mr. E. O. Preston, and that the Company appeared to have been brought into its present financial condition from the following chief causes: (1) Lack of working capital from the commencement and of capital to meet the demands of necessary extensions and repairs. (2) Entering into unremunerative arrangements for supplying water. (3) Heavy expense incurred in the issuing of a portion of the capital. (4) Lack of proper business and financial management. In connection with the second cause, Mr. Beeby mentioned, in particular, one arrangement entered into on Dec. 21, 1904, whereby the rights which the Ticehurst Company held to supply water to certain districts were parted with to the Gas and Water Works Supplies and Construction Company, Limited; the chief right only being retained to terminate the arrangement on condition that the Ticehurst Company bought up the land and works constructed for such supply. This arrangement always had been, and was now being, carried on at an unremunerative price. On Dec. 21, 1904, the Directors of the Company were Messrs. W. R. White, H. L. Currie, W. B. Martin, and Edmund Eaton (Managing-Director). The Directors of the Construction Company, on the same date, and their respective holdings, according to the filed return, were Messrs. W. R. White, W. B. Martin, Charles Wheeler, and Edmund Eaton, each holding 50 preference shares, and Messrs. Edmund Eaton and W. R. White also held jointly 1314 ordinary and 4000 preference shares.

Coming to the accounts, Mr. Beeby reported that he had examined into these up to Dec. 31, 1908, as published by the Directors; but, owing to the incomplete state of the books and the absence of sufficient material evidence, such examination was rendered very difficult, and he had confined his attention chiefly to the capital account. Under this head he wished particularly to call attention to an asset of £8265, which in the books purported to represent calls and shares unpaid. The first separate item in this amount was £3000, represented as unpaid calls for shares due by Edmund Eaton on 600 shares allotted to him on June 25, 1906. Yet the Directors' minutes of that date described these shares as fully paid; and a certificate for 600 fully-paid ordinary shares had actually been issued. It appeared that these shares were held by Mr. Eaton as Trustee for the Company; and they still stood in his name on the register—no transfer passing them back again having been registered. The reason alleged for this transaction was that the Company owed Mr. Eaton money, for which debt it was agreed to take debentures in part satisfaction. But before further debentures could be issued, it was discovered that, under the Act, further share capital would have to be raised; hence the issuing of these 600 shares. It was agreed that these shares should only be held by Mr. Eaton until transferees could be found, as per the minute of June 25, 1906. The second separate item was £4200, and was accounted for as the difference in the amount at which 1400 ordinary £5 shares were issued, and their nominal value. These 1400 ordinary shares were allotted to the Construction Company for a tender for certain works to be done for £2800, accepted by the Directors, and recorded in the minutes of meetings held respectively on Jan. 18, 1905, and Feb. 6, 1905. A certificate for 1400 fully-paid ordinary shares was issued. The other separate items were put down as £450—an amount received during the present year, and paid to Mr. E. O. Preston and debited to his loan account. £200, representing 40 shares allotted to Mr. F. Miller, as per minute of Feb. 24, 1903. (The books recorded no consideration for this allottment. The shares were transferred to Mr. E. Eaton as per minute of May 8, 1903.) £500, representing 100 fully-paid shares allotted to Mr. E. Eaton in consideration for land at the reservoir, as per minute of May 24, 1905; but the land account in the books had not been debited with this £500. The actual total of these five separate items was £8350, showing an untraced discrepancy of £85.

With respect to debentures, the report set forth that the Company had power to issue them on the basis of share capital subscribed. Deducting the £3000 representing the 600 shares in the name of Mr. Eaton, the subscribed share capital amounted £46,920, on which debentures amounting to £15,640 had been issued; but of this sum only £14,000 had been legalized by the granting of a certificate of a Justice of the Peace—a necessary proceeding under the Act. In addition, debenture issues had been made in disregard of the limitation of share capital; and a reference to the balance-sheet of Dec. 31, 1908, in the published accounts revealed an issue of £1500 of provisional debentures to certain creditors of the Company. To be added to these were the following: £700, further debenture certificates issued as collateral security to creditors, which creditors had transferred the debenture certificates to other holders; £1200, further debenture certificates issued for which there was no record of any consideration; and £1100, further debenture certificates issued to creditors—no records being found to show that these had parted with their certificates.

In the items of expenditure was a charge of £3500 for laying a 3-inch gas-main from the Ticehurst works to the boundary, Hurst Green. Here Mr. Beeby added the following note: "I have been informed by

local residents and two of the present Directors of the Company that they are of the opinion that the work for this charge has not been carried out. As regards the other items specially enumerated, my inquiries have not been able to ascertain whether the work for which the charges are made has been completed, or whether any part is chargeable to the promoter."

The creditors of the Company, as shown by the ledger, are Messrs. E. O. Preston and Co. (moneys advanced), £2242 2s. 9d.; Water-Works, Lighting, and Power Investment Corporation, £800; W. L. Christie, £977 14s.; Hardwicke Colliery Company, £834 8s. 7d.; Gas and Water Works Supplies and Construction Company, Limited, £1566 9s. 3d.; and other creditors, £2596 2s. 10d.—making a total of £9016 17s. 5d.

Mr. Beeby concluded his report as follows: "As to the present, the works are still being carried on, and the Managing-Director, Mr. A. W. Lunt, is sparing no pains to bring the Company, which supplies a valuable area, to a better footing. There are certain repairs needed, some of which have already been put into execution as being necessary to a continuance of the business. In this report I have dealt with all matters upon which I have been able to obtain particulars from the books and documents of the Company that have come into my possession. But these are manifestly incomplete; and there are many other things calling for explanation, particulars of which would have to be obtained from other sources."

The reading of the report was followed by silence; the obvious expectation being that the Chairman would speak. As nothing was heard,

Mr. HOOPER asked the Chairman to state whether, since the inception of the Company, properly audited and certified accounts had ever been presented and passed, or any statement made of the Company's financial affairs that was not accompanied by some covering statement pointing out gross irregularities.

The Chairman being unable to satisfy his questioner on this point,

Mr. HOOPER proposed the following resolution: "That, owing to the absence of properly audited accounts, the absence of books, the submission of vague reports, and general mismanagement, the conduct of the Directors of the Company is to be severely condemned; and this meeting of the shareholders, in dispensing forthwith with the services of the Directors, passes a vote of censure."

The CHAIRMAN protested that the resolution was couched in unwarrantably strong language; and, in defence of himself and his colleagues, he pointed out that they had not held office continuously. He admitted, however, that they had been on the Board of Directors for the past two-and-a-half years.

Mr. HOOPER said he would go no further than the Chairman's own admission. For two-and-a-half years continuously he had been Chairman of the Company, and yet during all that time he had never taken any steps to recover a large sum of money—£8265—which, according to the books, was due on unpaid calls. More than this, he had never even ascertained if this money was actually due. If this did not constitute gross neglect and mismanagement, he (the speaker) could not imagine what did.

The CHAIRMAN still objected to the terms of the resolution.

Mr. GLOVER, in seconding the motion, said that, in his opinion, the terms employed by Mr. Hooper were not strong enough. It was an instance of scandalous mismanagement. It was not proposed to let the inquiry end there. Before they finished, they hoped to be able to bring the matter home to the guilty parties; and when this was accomplished, they would know how to deal with them. [This remark was received with loud expressions of approval.]

The motion was then put and carried unanimously.

Mr. HOOPER said it seemed only right and proper, before dispersing, that new Directors should be appointed; and he proposed the names of Messrs. C. S. Glover, W. H. Collier, and A. W. Lunt.

The motion was seconded by Mr. GIBBS, and carried unanimously.

The subsequent discussion was of a desultory character; Mr. White, and afterwards Mr. Martin, explaining their motives while in office, and asseverating that they acted throughout solely for the benefit of the Company. Both gentlemen alluded to their voluntary relinquishment of all Directors' fees during their last term in office.

Mr. GIBBS, however, referred to fees drawn by these gentlemen during previous tenures of office.

Mr. MARTIN said his total fees and allowed expenses during his entire connection with the Ticehurst Company did not exceed £36.

Mr. GLOVER pressed Mr. White to give the amount of his fees.

Mr. WHITE said he was unable to do so. He denied, however, that they approximated £500, or anything like it.

The proceedings then closed.

Inspection of Consumers' Gas-Fittings at Portsmouth.—The officials of the Portsea Island Gas Company are issuing invitations to the consumers to allow a gratuitous inspection of the whole of their internal fittings, with a view of securing the best illuminating results. All incandescent mantles are, of course, to be paid for. Business shops and public buildings will be inspected every fortnight, and private residences once a month.

Wilful Waste of Water.—A man named Hero Scott was last Wednesday fined £1 and costs, with the alternative of 14 days' hard labour, for wilfully wasting water belonging to the Devonport Corporation. William T. Lee, a water inspector, and other employees of the Water Department, as well as several policemen, gave evidence that on various dates water had been found running to waste on defendant's premises. He had been spoken to about it, but had treated the warnings with contempt. Thousands of gallons of water could run through the tap in the course of a day. Mr. F. W. Lillicrap, the Corporation Water Engineer, said that in consequence of the reports of the waste of water he had written to the defendant, but without effect. Defendant now said that his eldest son, who was deranged, had a mania for turning the tap and letting the water run away; and another son said his brother did it to annoy the neighbours. The Magistrates said it was the defendant's duty to take steps to control his son; and if he did not prevent the waste of water, he would be dealt with more severely.

THE AMALGAMATION OF BUENOS AYRES GAS COMPANIES.

The Terms of the Agreements.

In the "JOURNAL" last week (p. 771), it was mentioned that meetings of the three Companies concerned in the above-mentioned amalgamation—the Primitiva Gas and Electric Lighting Company and the Buenos Ayres (New) and River Plate Gas Companies—had been convened for to-day to confirm the agreements provisionally entered into. The following are the terms on which the proposed fusion will take place: The Primitiva Company will acquire the whole of the assets and undertaking of the River Plate Gas Company, subject to the outstanding liabilities, which include £350,000 of 4 per cent. debenture stock; the consideration being an allotment, credited as fully paid, of 200,000 5 per cent. cumulative preference shares and 100,000 ordinary shares, all of £5 each, ranking *pari passu* with the existing preference and ordinary shares of the purchasing Company as from the 31st inst. They will acquire the whole of the assets and undertaking of the Buenos Ayres (New) Gas Company, except £150,000 of shares in the South Barracas (Buenos Ayres) Gas and Coke Company, Limited, subject to the outstanding liabilities, which include £250,000 of 4 per cent. debenture stock, and certain payments for compensation to Directors for loss of office; the consideration being an allotment, credited as fully paid, of 100,000 5 per cent. cumulative preference shares and 50,000 ordinary shares of the purchasing Company, all of £5 each, ranking *pari passu* with the existing preference and ordinary shares as from the 31st inst. Each of the selling Companies will be entitled to retain out of its assets sufficient to pay a dividend on the share capital for the current year at the same rate as was paid for 1908. These arrangements will permit of a distribution of two preference shares and one ordinary share, all of £5, in the Primitiva Company in exchange for one £10 share in the River Plate Company; and of £5 in cumulative preference shares and £2 10s. in ordinary shares in the first-named Company in exchange for every £7 of the shares of the Buenos Ayres (New) Company, the shareholders in which will receive in addition their *pro rata* amount of the £150,000 of fully-paid shares in the South Barracas Company.

BRITISH COALITE COMPANY, LIMITED.

The following is the report of the Directors of the Company for the year ended Sept. 30, which (with the accounts) will be presented at the ordinary general meeting of shareholders to-day.

Since the close of the financial year, a further sum of £62,500 has been received from Coalite, Limited, in further reduction of the liability on unpaid calls, and which could not be brought into the accounts now presented. The balance will be liquidated early in the ensuing year.

As the past twelve months have been almost entirely occupied in continuing the development and constructional work mentioned in previous reports, the volume of business done has not been sufficient to permit of a profit being realized on trading account.

Very extensive plant is being erected at Barking, Wednesfield, Plymouth, and Hythe. The delay in completion has been unavoidable, as the economical expenditure of a large capital is necessarily a question of time, and cannot be hurried. The Directors have the fullest confidence in the immediate financial success of the undertaking.

The year in question has been occupied chiefly with the erection of the above coalite-producing plants, but it has also developed new features of great importance to the Company, commercially and scientifically; and the improvements in manufacture mentioned in our report of last year have shown highly economical results, which will add to the profits of the enterprise.

New batteries have been completed at Barking, and others are in course of erection. Plans are already prepared of further extensions for handling greatly increased quantities of coal and coalite. A large distilling plant at Barking is nearly completed, and will be capable of dealing with the whole of the tar produced there and at Plymouth, Hythe, and other works.

The Wednesfield works continue to run steadily, and give a satisfactory output. The foundry turns out excellent work, and has enabled the Directors to effect great economies in constructional costs.

The plants at the works of the Plymouth and Stonehouse Gas Company and the Hythe and Sandgate Gas Company are giving steady returns; the gas being rich in illuminating power, the quality of which exceeds the contract requirements.

Further contracts are being negotiated with other gas companies which it is hoped will be brought to a conclusion at an early date.

The Directors are pleased to report that the only First Diploma of Merit was awarded to "Coalite" at the Sheffield Smoke Abatement Exhibition in March of the present year; and at the White City Exhibition, 1909, the Gold Medal was gained in the Smoke Abatement Section.

The demand for the fuel coalite increases daily; and the original scheme outlined in the prospectus for supplying London is being steadily pushed forward.

The accounts accompanying the report show that the sales of coalite and bye-products brought in £11,376; the value of these materials used in manufacture and in the foundry is put down at £1044; and the stock of them at £1830. A sum of £6452 represents interest received on calls in arrear, and £5946 the amount accrued to the date of the accounts—making together £12,398. A sum of £21,895 is carried to the balance-sheet; and a few small items make up a total of £51,118. On the expenditure side of the account, the amounts spent at the Barking, Wednesfield, and Plymouth works are set out as follows: Coal, coalite, and bye-products, £16,327; wages and salaries, £13,196; rents, rates, and taxes, repairs to plant, machinery, and buildings, &c., £4855; carriage, sacks, and packing-cases, £2010—total, £36,388. The head office expenses for the year, including Directors' fees, salaries, legal and other charges, &c., were £11,410; fees paid to the Consulting Engineer and Chemist amounted to £818; other items make up a total of £51,118.

POSITION OF TAUNTON ELECTRICITY UNDERTAKING.

The "Strong Indictment" by the "Journal."

In the "JOURNAL" for the 23rd ult., some comments were made in "Electricity Supply Memoranda" on the position of the electric light undertaking of the Taunton Corporation, as revealed in a report prepared by Mr. Albert C. Mole for the Taunton Chamber of Commerce. The comments were reproduced in the local papers; and the attention of the Town Council was called to them at the meeting last Tuesday, by Mr. E. T. Alms, a newly-elected member, who is a local Solicitor and Clerk to the Magistrates of the County Petty Sessional Division. On the Chairman of the Electricity Committee (Dr. Macdonald) moving the adoption of their monthly report, Mr. Alms remarked that the article referred to contained a "strong indictment" with regard to the financial position of the electricity works. At this point, the Mayor (Mr. W. H. Westlake) interposed, and said that as this matter was not mentioned in the report of the Committee, it ought not now to be introduced. Mr. Alms thereupon asked whether he must confine himself entirely to the Committee's report; and the Mayor replied that he could express an opinion on anything mentioned in it, or ask a question respecting any matter referred to with which he was not satisfied. Mr. Alms pointed out that as a very strong indictment had been made against the electricity undertaking, he considered it was a matter of public interest that attention should be called to it. The Town Clerk (Mr. G. H. Kite) read a section of the Council's byelaws to the effect that only matters mentioned in the monthly reports could be dealt with by the Council until the end of the meeting, when memorials could be presented, or complaints received. Mr. Alms said he was neither presenting a memorial nor making a complaint. He was simply saying that the report of the Electricity Committee did not deal with the position of the undertaking. He repeated that a very strong indictment had been made against its financial position; and he thought it was due to the ratepayers of the town that the indictment should be clearly met, and it should be put before them as to whether or not it was true. The Mayor said that the matter had already been considered by the Council, and the attention of the Local Government Board had been called to it. Mr. Penny asked whether it was not a fact that the Electric Light Committee had fully reported on the question of the financial position of the undertaking. He should not like it to go forth that the Committee had burked the thing; but they were not in the habit of replying to what appeared in the newspapers, and they had already communicated to the Chamber of Commerce, who had first called attention to the matter, the Council's decision on the subject. The Town Clerk remarked that, inasmuch as the Council kept their accounts (including those of the electricity undertaking) in accordance with the requirements of the Local Government Board, they had invited the Chamber of Commerce to investigate the accounts for themselves, if they desired, or get the Local Government Board to hold a public inquiry on the matter. This communication had been sent by the Council to the Chamber of Commerce, who had forwarded it to the Local Government Board. Since then he had not received any further communication as to how it had been received. Dr. Macdonald said he had nothing to add to the remarks which had been made. The matter then dropped, and the report was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On Tuesday, in the Stonehaven Town Council, Bailie Robertson moved that the Council take steps to ascertain on what conditions the Stonehaven Gas Company would sell their undertaking to the Council. He did not, he said, want to quarrel with the Company. They had managed their business very well, and ought to be paid a fair price for their undertaking. He understood that the Company had 2500 shares, at 30s. each, which was equal to £3750. The present selling price of each share was about £3 10s. 6d.; and they paid a dividend of 17½ per cent., equal to £67 10s. In Carnoustie, the annual make of gas was 23¾ million cubic feet; in Stonehaven, the annual consumption was 16½ millions. In Carnoustie, the offer of the Town Council was £21,000. For the works in Stonehaven, he thought £14,000 would be a fair price. This sum, repayable in thirty years, would amount to £732 annually; but if they adopted the Gas Supply Act, they could repay the money in forty years, which would make the annual contribution less, and would leave about £80 more than the Company at present required for the payment of dividend. He thought the Company deserved great credit for the way they had done their work. In no town in Scotland, of similar size, did he find cheaper gas. The subject of taking over the gas-works was before the Council more than twenty years ago, and again ten years ago. He thought that it might be to the advantage of the Council to take them over just now. The motion was agreed to unanimously; and the whole Council, with the exception of Provost Torry and Mr. Mitchell, who are Directors of the Company, were appointed a Committee of Inquiry.

In an address to Liberal electors in Glasgow on Wednesday evening, Councillor Duncan Graham dealt with some of the proposals which had been considered in connection with the recent House Letting Bill. One of the questions, he said, which had engaged the attention of the Corporation on this and previous years was the large annual deficit of about £23,000 which was incurred in connection with the lighting of common stairs and private streets. Under the Glasgow Police Act, the charge for lighting common stairs was 10s. per burner, and for lighting private streets 15s. per lamp; whereas the Burgh Police Act allowed the Town Councils of other burghs to charge 20s. for stair lights and 25s. for private street lights. If the scale of charges allowed by the Burgh Police Act were applicable in Glasgow—and they could be made applicable by a simple resolution of the Corporation—this deficit of £23,000 would be wiped out. At present the deficit was met by adding 1d. to the municipal assessments, charged upon occupiers only; so that if the rates for the lights were increased, it would mean a reduction of 1d. on the Glasgow municipal assessments. The reason why the lighting of stairs and private streets had not been placed on the general assessment was simply because this was paid by the occupiers of all premises, and was not contributed to by the proprietor. Lighting of stairs and private streets was charged against the owners, with a right of relief against the occupiers in the case of common stairs.

The Arbroath Town Council had before them on Monday a claim for £2 as damages for gas poisoning, arising out of the fracture of a gas-main in Church Street by the use of a road-roller. It was stated that Mrs. Walker, the wife of the tenant of the house at No. 12, Church Street, smelt gas in the house, but she and her husband did not think it sufficiently serious to necessitate sending information to the gas-works, and they retired for the night. In the morning, Mr. and Mrs. Walker and a child were found by neighbours in a semi-conscious condition. Mrs. Walker recovered almost immediately; but the husband and child were more seriously affected. The claim was allowed.

I would call attention to the opinion of Mr. W. L. Macindoe, the Town Clerk of Kirkcaldy, given on another page, with reference to the gas transfer in that town. Mr. Macindoe reaches conclusions which are a distinct variation from those arrived at by much more distinguished lawyers than himself; but his opinion is not, on this account, to be set aside as erroneous. Counsel give their opinion in any particular case upon the memorial which is placed before them; and it is quite possible that previous opinions may have been erroneous because the framers of the memorials were not sufficiently intelligent to place the matter properly before counsel. Mr. Macindoe's opinions as to the allowance for compulsory purchase, and the decreased amount which ought now to be eligible, are extremely important. They introduce a new element into arbitrations—that is to say, if Mr. Macindoe is to be accepted as right. Whether he be or not, his views are certain to be pressed in the course of arbitration proceedings, not necessarily in connection with gas transfers only, but upon other subjects, such as the acquisition of lands and the like. This gives some idea of the wide-sweeping nature of the document which we publish.

The dinner of the Western District of the Scottish Junior Gas Association this evening need not be referred to in this column, were it not for the purpose of expressing gratification at the presence of Mr. G. R. Hislop, of Paisley, at the gathering. It was a great compliment to the Juniors that one so eminent in his profession as Mr. Hislop should have come among them and taken part in their proceedings. Such encouragement given to them ought to urge on the Juniors everywhere to more strenuous effort in the cause of the industry.

In the Hamilton Town Council on Tuesday, the Gas Committee reported that, in terms of the remit from the previous meeting of the Council, they had discussed the subject of the present price charged for gas consumed through prepayment meters, and that they had instructed the Manager—Mr. J. Ballantyne—to prepare and submit a report showing the expenditure upon free piping, prepayment meters, &c., in order that the terms of sections 17 and 23 of the Act of 1909 may be complied with.

In the Ayr Town Council on Monday, Mr. W. Smith had the hardihood to oppose a proposal to extend the use of electric lighting in the streets of the town. He stated that in 1895, before the electricity works were started, the cost of lighting the burgh was £1500 a year, whereas it was now £4837. He admitted that the town was now better lighted, but contended that it could be lighted by incandescent gas-lamps at half the cost. Mr. Smith, however, did not find a supporter; and the recommendations of the Lighting Committee were adopted.

At the annual meeting of the Turriff Gas Company, Limited, held last week, a dividend at the rate of 5 per cent. was declared; and it was agreed to continue the price of gas at 6s. 3d. for lighting and 5s. 3d. for cooking and heating.

A gentleman who is said to have accidentally dropped a lighted match the other day in the public park at Wishaw, was surprised to find that a flame burst up to a height of about 2 feet. The authorities were informed. A sample of the escaping gas was taken; and an analysis showed that it was natural gas. The matter was brought before the Town Council at their monthly meeting on Monday, and instructions were given to have the ground protected against possible injury to children. It is supposed that the gas arises from old underground coal workings. At the same meeting of the Council, Bailie Bell, the Convener of the Gas Committee, objected to a proposal by the Committee, passed at a meeting he was unable to be present at, to sell coke to local bakers at 1s. per ton lower than the average price at the gas-works. It was pointed out that the reduction was more apparent than real, as the bakers will have to load and cart the coke themselves. The recommendation of the Committee was agreed to by eight votes to four.

Concessions to Large Consumers in Manchester.—In response to applications made by certain large firms, the Gas Committee of the Manchester Corporation have decided to make concessions in price to those consuming not less than a million cubic feet of gas per annum.

Increased Rates v. Increased Gas and Water Charges.—A proposal of the Morley Gas Committee to increase the price of gas from 2s. 9d. to 3s. per 1000 cubic feet from the 1st prox., and that the Committee should be empowered, if thought desirable, to revise the scale of discounts to large consumers, was the subject of a long discussion by the Town Council. The proposal was the outcome of a suggestion by the Mayor that, in view of the probable necessity for raising more money in the borough, the prices of gas, electricity, and water should be put up, with the object of avoiding any increase in the already rather heavy rates. It was contended by several speakers that the burden of the increase in the price of gas would fall upon the small consumers, and that of the occupiers of the eighteen mills in the borough that were not already lighted by electricity many would instal electricity plant to avoid the payment of the increased cost of gas, thus causing a loss of revenue to the gas undertaking. It was suggested that, if anything should be increased in price, it was the water supply to the manufacturers; the charge at present being only 6½d. per 1000 gallons. An amendment deleting the proposition was carried by a majority of nearly the whole Council. A recommendation of the Electricity Committee, to advance the price of electricity for lighting purposes from 5d. to 6d. per unit, was adopted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 18.

Sulphate of Ammonia.

There has been renewed activity during the past week, occasioned not only by dealers covering their requirements for December shipment, but to a certain extent also by a better demand from consumers both in this country and abroad. A further advance in prices has to be recorded; and the market closes at its best. The nearest values to-day are £11 6s. 3d. to £11 7s. 6d. per ton f.o.b. Hull, £11 8s. 9d. to £11 10s. per ton f.o.b. Liverpool, and £11 7s. 6d. to £11 8s. 9d. per ton f.o.b. Leith, from which it will be observed that Liverpool shows the greatest improvement. For January-June delivery next year, the majority of makers maintain their quotation at £11 12s. 6d. per ton; but so far this figure is not reported to have been paid, the bulk of the requirements being apparently in the near position. A small amount of business has transpired, however, at £11 10s. per ton f.o.b. shipping ports for January-March, 1910.

Nitrate of Soda.

This article remains unchanged; buyers showing little disposition to operate, and sellers holding firmly for 9s. 3d. and 9s. 6d. per cwt., on spot, for ordinary and refined qualities respectively.

LONDON, *Dec.* 20.

Tar Products.

The markets for tar products have been steady throughout the past week. In pitch, there has been a decided improvement; there having been further inquiry from the Continent, and some of the French buyers have paid advanced prices. The Belgians still decline to come on for next year except at prices which are considerably below the equivalent of those asked in England to-day. No business of importance has taken place in London; but on the east coast 27s. 6d. is reported to have been paid and also declined. On the west coast, good figures have been offered. In Scotland, pitch is very firm indeed. Creosote is steady. London makers are still practically out of the market, as is also the case in the Midlands. In the North, in some districts oil is decidedly cheap; but in other quarters manufacturers are apparently well sold, and quite content to wait for the present. Benzol, 90 per cent., is very firm for prompt delivery. In the North, 6d. has been paid; and it is doubtful whether anything under 7d. would be accepted in London. Fifty-ninety per cent. benzol is firm, while toluol appears to be decidedly scarce for early delivery. Solvent naphtha is firm; and there is a decided scarcity in the London and Manchester districts. Carbolic acid is very weak; while crystals are practically unsaleable. Naphthalene is depressed, and quantities of pure which are acquired are very small; but salts are in good demand.

The average values during the week were: Tar, 13s. 6d. to 17s. 6d., *ex* works. Pitch, London, 27s. to 27s. 6d.; east coast, 26s. 6d. to 27s. 6d.; west coast, 26s. 3d. to 27s. 3d. f.a.s., 27s. 6d. f.o.b. Benzol, 90 per cent., casks included, London, 6⅞d. to 7d.; North, 6d. to 6¼d.; 50-90 per cent., casks included, London, 7⅜d.; North, 6⅞d. Toluol, casks included, London, 9⅜d. to 10d.; North, 9d. to 9¼d. Crude naphtha, in bulk, London, 4d. to 4¼d.; North, 3⅞d. to 4d.; solvent naphtha, casks included, London, 1s. 1d. to 1s. 1½d.; North, 11½d. to 1s.; heavy naphtha, casks included, London, 10⅜d. to 11⅜d.; North, 10d. to 10½d. Creosote, in bulk, London, 2¼d. to 2⅝d.; North, 2⅛d. to 2¼d. Heavy oils, in bulk, 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 10⅜d.; west coast, 10¾d. Refined naphthalene, £4 10s. to £8 10s.; salts, 40s., packages included and f.o.b. Anthracene, "A" quality, 1⅛d. to 1⅜d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been steady during the past week, and prices have advanced to 2s. 6d. per ton all round. In London, it is doubtful whether outside makes can be secured upon Beckton terms under £11 3s. 9d.; while the principal Gas Companies ask £11 8s. 9d. for prompt, and £11 12s. 6d. for January-June. In Hull, tender parcels are reported to have been sold at very good prices indeed; and it is doubtful whether anything can be obtained at under £11 5s. to £11 7s. 6d. In Liverpool, £11 7s. 6d. is said to have been paid. In Leith, makers have very little to dispose of, but report having declined £11 8s. 9d., and ask £11 12s. 6d. for January-June.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade in the North has been agitated the last few days by the critical nature of the negotiations between coalowners and miners as to the arrangements under the Eight Hours Act. While in Durham the matter has been amicably settled, in Northumberland there have been difficulties that are not readily surmounted, and that have influenced the sales and the markets. Best steam coals are now nominally about 11s. per ton f.o.b. There is, however, very little for sale for this year now; and until there is more of a settlement, owners do not readily sell further forward. Second-class steams are about 10s. per ton f.o.b., and steam smalls from 5s. 3d. to 6s. 6d. In the gas coal trade, the demand is now at its fullest, both on contract and for occasional cargoes; and prices are very firm. Best Durham gas coals are 11s. to 11s. 3d. per ton f.o.b. Other qualities vary from 9s. 6d. to 10s. 3d.; and "Wear specials" are from 11s. 6d. to 11s. 9d. The demand continues for next year; but coalowners are not quite so ready to quote forward, as they have sold forward freely, and there is a considerable activity in the request for prompt supplies. Small forward contracts are quoted something near the current prices. Coke is steady; and gas coke is firm considering the heavy

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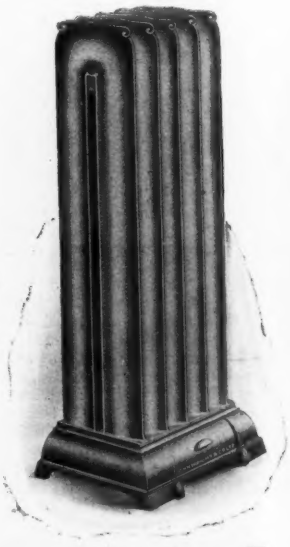
For poorly ventilated and over-crowded Offices—its Consort—the "Official"—is fast making its unique merits known.

The "St. Andrew."

The "Official."



JOHN WRIGHT & CO.,
The Radiator Experts,
Essex Works, BIRMINGHAM.

221.

production at present. Good gas coke is from 12s. 9d. to 13s. 6d. per ton f.o.b. Tyne or Wear.

Scotch Coal Trade.

Trade is good, and the prospect is better than it has been. Prices are, however, as yet unaffected. The quotations now are: Ell 9s. 9d. to 10s. 6d. per ton f.o.b. Glasgow, splint 10s. 6d. to 10s. 9d., and steam 9s. 3d. to 9s. 6d. The shipments for the week amounted to 284,786 tons—an increase of 7369 tons upon the preceding week, but a decrease of 10,976 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,606,981 tons—an increase of 657,255 tons upon the corresponding period.

Universal Gas Methane and Buisson Hella Company, Limited.

A petition asking the Court to sanction a scheme of arrangement for the distribution of the assets of the above-named Company among the shareholders came before Mr. Justice Swinfen Eady last Tuesday. The Company was formed with a nominal capital of £600,000, to acquire certain French patents for the mantle named in the title. It was proposed to pay the debts and divide the remaining assets of the French Company which had recently been sold. The English patents had been disposed of to an English Company, in consideration of 80,000 shares; and the French and other patents all over the world had been sold to the French Company. The latter Company bought from the former the 80,000 shares, so that they would get the benefit of the whole of the invention. His Lordship sanctioned the scheme.

Progress of "Coalexld."

We learn from Mr. J. Jowett, the Managing-Director of Coalexld Limited, that good progress is being made with the use of the material. Last month, the sale of chemicals increased more than 50 per cent. as compared with the corresponding month of the past year, and up to last Saturday there was a still larger increase. It is being found that gas engineers are beginning to make "Coalexld," as it is helpful to them in the disposal of their regular supply of coke, which, when converted into "Coalexld" finds a readier market than it does in its ordinary condition. It is now, we are informed, adopted largely by the users of anthracite stoves; and, according to a testimonial recently received from the "National" Gas-Engine Company, Limited, it is found to be excellent for use in suction-gas plants. The Managing-Director's assistant (Mr. F. W. Robson) writes: "It gives good gas, is free from tar, and there is no trouble with clinker in the generators. From this point of view we are able to speak of it in the highest terms; and we will have every confidence in recommending 'Coalexld' for use in suction-gas plants." Mr. Jowett has just completed some tests, in an ordinary household sitting-room grate, with coal and "Coalexld." Half-a-hundredweight of the latter, costing 6d., burnt exactly the same length of time as a hundredweight of coal, costing 1s. 3d., gave out more radiant heat, and made a beautiful fire, without smoke.

Improved Public Lighting at Swansea.

At the meeting of the Swansea Town Council last Wednesday, the Surveyor reported the result of his negotiations with the Manager of the Gas Company (Mr. G. Thornton Andrews) with reference to a scheme for improving the street gas lighting by the conversion of all the flat-flame burners to incandescents; and upon his recommendation it was resolved to adopt the following proposals as mutually agreed between them: (1) That the Company convert all the flat-flame lamps to incandescent burners, to consume 3½ cubic feet of gas per hour, within three years from Jan. 1, 1910; the conversion to be equally distributed throughout the three years, and the selection of the lamps to be so converted to be made by the Corporation. (2) That the annual charge for the present 4½ cubic feet per hour incandescent lamps remain the same as now—viz., £3 13s. 5d.—and the annual charge for all 3½ cubic feet per hour incandescent lamps be £2 15s. 1d. (the charge now made for the existing flat-flame lamps), no initial charge being made for conversion. The foregoing charges are based upon the price of gas being 2s. 8d. per 1000 cubic feet. (3) That the Corporation supply during the period of conversion a number (not exceeding 100 per annum) of new lanterns of a modern type to the approval of the Company to replace lanterns worn out or mutually deemed obsolete, at a price not exceeding 16s. 6d. each, including porcelain reflectors and copper chimneys; and that the remainder of the lamps, as and when converted, be fitted with porcelain reflectors and copper chimneys by the Company at a cost not exceeding 4s. per lamp, to be paid by the Corporation. (4) That the annual lighting hours remain as at present—viz., 3473. (5) That in certain streets and roads, to be subsequently defined, where there is not at present any electric cable laid, nor likely to be in the near future, the Corporation undertake that gas-lamps, altered to new burners, shall not be displaced by any other form of lighting for a number of years to be agreed.

Cost of the Holsworthy Water-Works.—It was reported at a meeting of the Holsworthy District Council last Tuesday that the new water-works were now practically complete. Mr. Parsons said the original contract was for £4740, but the actual cost to date was £7140. The increases over the estimate included £812 on account of the reservoirs, £514 for the filter-beds, and £400 for engineering expenses. It was decided to apply for permission to raise a further loan of £2400.

Gas Scheme for Warsop.—It may be remembered that one of the Provisional Orders for which application is being made to the Local Government Board (see *ante*, p. 624) is to enable the Warsop Urban District Council to supply gas, and to erect the necessary works and plant. Warsop is a little town of nearly 5000 inhabitants on the border of Sherwood Forest, and the right to supply gas to it has been held by the Mansfield Corporation. They have, however, now disposed of it to the District Council, who have instructed Mr. Arthur Graham, the Gas and Water Engineer to the Corporation, to carry out a complete scheme for them as soon as the Order is obtained.

THE

INTERCHANGEABILITY and HIGH EFFICIENCY

OF

Richmond's "A.B.C." Gas Fires

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ARABIAN.

BAVARIAN.

CASTILIAN.

"CONSUMING"

Topic heard in the Gas Industry to-day. We welcome the most exhaustive tests. Over 500 Gas Companies and Departments are Hiring and Hire-purchasing these Fires to-day.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.

London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington.

Explosion near Blackfriars Bridge.

About noon last Wednesday, some commotion was caused at the north end of Blackfriars Bridge by the sudden upheaval of several yards of pavement under the railway bridge which crosses the west end of Queen Victoria Street. A workman who was descending a manhole was blown into the street, another was knocked down, and a pedestrian was injured on the leg by a flying fragment. Fortunately the casualties were not more serious. It appears that the explosion was caused by one of the Post Office officials going down into a chamber, some 10 feet square, containing electric cables. It is believed that he had been warned by one of the Gaslight and Coke Company's men that there was gas about; but, notwithstanding this, he struck a match to light his candle, with the result that an explosion followed. As our readers are aware (*ante*, p. 665), there has lately been an alteration in the levels of the mains at this spot, in connection with the construction of the passenger subway; and the gas came from a split cap on one of the mains which had been lowered. The matter was referred to at the meeting of the Court of Common Council next day, when the Chairman of the Streets Committee explained that in the diversion of the main a leakage of gas developed through a defective joint. This was made up with lead, and the pipe embedded in concrete; but the leak continued. He added that the Corporation were in no way responsible for the explosion.

Reduction in Price by the Gaslight and Coke Company.—As already intimated in the "JOURNAL," the price of gas in the district of the Gaslight and Coke Company will be reduced 1d. per 1000 cubic feet (from 2s. 9d. to 2s. 8d.) as from the end of the current quarter.

Reinstatement of Roads after Disturbance.—The Surveyor to the Camborne District Council reported at the last meeting of that body that he had been in communication with the Water Company with reference to the reinstatement of the surface of roads after disturbance by the Company. Some of the repairs had been done in a way, but the metal used was not of the quality required for county roads; and he suggested that the Council should give him authority to do the work properly, and to fix a time limit in which the Company should act. Mr. Passmore said the roads were always being taken up by somebody, and it would be better if the Council were to repair them and charge the parties with the cost. The Surveyor said he had been endeavouring for some time to get this done. It was decided that the Surveyor should again suggest to the Company the desirability of this arrangement being carried out.

New Reservoir for Cardiff.—Mr. C. H. Priestley, the Engineer, has given the Cardiff Water Committee some interesting figures in regard to the new reservoir in the Beacons. It will have a water area of 144 acres, compared with an area of 51 acres of the No. 1 Beacons reservoir, and 42 acres of the Cantref reservoir. The capacity will be over 1200 million gallons. Cantref has a capacity of 323 million gallons, and No. 1 reservoir of 345 million gallons. The actual cost of Cantref was £160,087, and of No. 1 reservoir £213,353; while the cost of the new reservoir, with a capacity four times as great as either of the other two, was estimated at £288,000. The Committee subsequently discussed the acquisition of further land in connection with the construction of the reservoir. Alderman Beavan asked if this land was contemplated in the original estimate of the cost of the reservoir. Mr. Priestley replied that it was not, and added that the additional land was wanted because Parliament had given them an increase of 5 feet in the depth of the reservoir. The estimated cost of the deeper reservoir was about £290,000; but this sum did not include the cost of the land now required. This land, however, would be let at a remunerative rental; so that, in reality, the total cost of the deeper reservoir would not exceed £290,000. It was decided to negotiate for the purchase of the land.

APPLICATIONS FOR LETTERS PATENT.

28,390.—VALENTINE, H. S., "Gas-fires." Dec. 6.
28,395.—RYAN, J., "Mantle holder." Dec. 6.
28,467.—DICKER, S. G. S., "Analysis of gas." A communication from Underfeed Stoker Company of America. Dec. 6.
28,470.—WILKINS, T. M., "Valves." Dec. 6.
28,472.—HIBBERD, C. E., "Gas-meters." Dec. 6.
28,591.—LAKE, W. E., "Gas lamps and heaters." A communication from the Rector Gas-Lamp Company. Dec. 7.
28,610.—TEED, F. L., SULMAN, H. L., and PICARD, H. F. K., "Recovery of sulphur from gases." Dec. 7.
28,644.—AINLEY, L., "Meter money-box." Dec. 7.
28,704.—BENTLEY, A. W., "Mantle support." Dec. 8.
28,706.—HAMILTON, J. B., and J. B. HAMILTON AND CO., LTD., "Governors." Dec. 8.
28,736.—BERRY, J., MAYLOR, J. A., and METERS LIMITED, "Prepayment meters." Dec. 8.
28,790.—HINKS, J., AND SON, LTD., and HINKS, H. D., "Gas-pendants." Dec. 8.
28,807.—SIEMENS BROS. AND CO., LTD., "Disc water-meters." A communication from Siemens and Halske Akt.-Ges. Dec. 8.
28,826.—WISE, F., "Acetylene generators." Dec. 9.
28,864.—ALLEN, C., "Gas-cookers." Dec. 10.
28,867.—LOGAN, A., "Water-meters." Dec. 10.
28,868.—RADCLIFFE, J., "Recovery of ammonia from distillation gases." Dec. 10.
28,870.—DARWIN, H., and PERRY, W. F., "Lighting of burners from a distance." Dec. 10.
28,884.—BADCOCK, E. B., "Internal-combustion water-pumps." Dec. 10.
28,904.—HUGHES, J., "Gas-heated irons." Dec. 10.
28,935.—SUGG, W., AND CO., LTD., and SUGG WRIGHT, E., "Inverted lamps." Dec. 10.
28,937.—FALK, S., "Incandescent burners." Dec. 10.
29,029.—LAKE, W. E., "Manufacture of gas from hydrocarbon oils." A communication from the Hydrocarbon Converter Company. Dec. 11.
29,031.—SERNÉ, L., and NEIGHBOUR, R. C., "Gas heating-appliances." Dec. 11.

The "ONYX."

13-inch Fire Opening.

NOTE

The Wide Fire Opening, Intense Pillar Fuel, and Oval Fire Front,

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RESULTS OBTAINED ARE UNEXCELLED FOR EFFICIENCY AND ECONOMY.

ALL SINGLE ROW FUEL FIRES ARE SUPPLIED WHEN REQUIRED WITH THESE IMPROVEMENTS.

The "AGATE."

15-inch Fire Opening.

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(Incorporating Maughan's Patent Geyser Co.),

BIRMINGHAM: Stour Street.

LONDON: Office and Show-Rooms: 129, High Holborn, W.C.

Price of Gas at Aberavon.—At the monthly meeting of the Gas Committee of the Aberavon Corporation on Monday of last week, the question of a reduction in the price of gas was considered; and it was decided to lower the charge from 4s. 2d. to 3s. 6d. per 1000 cubic feet to ordinary consumers. Formerly the prices were 4s. 2d. per 1000 feet for lighting, and 3s. 4d. for cooking, heating, and power purposes by separate meter. The average was 3s. 9d. per 1000 feet; and the new price of 3s. 6d. will thus represent a reduction of 3d. per 1000 feet in the receipts. Prepayment consumers are also to have a reduction of 6d. per 1000 feet—19 feet instead of 17 feet for a penny. For power purposes and public lighting, the price will remain at 3s. 4d. The change will take effect from the 1st prox.

Revised Water Charges at Huddersfield.—On the recommendation of the Water Committee, the Huddersfield Corporation have adopted the following revised scale of charges, to come into operation on the 1st of April next: The charges for water supplied by meter inside the borough will be at the rate of 9d. per 1000 gallons for the first 800,000 gallons used per half year, and 7½d. per 1000 gallons above this quantity, and those outside the borough will be 1s. and 10d. per 1000 gallons respectively; the charge for water for domestic purposes to dwelling-houses, public-houses, temperance hotels, eating-houses, and clubs will be increased 1 per cent. on the present basis; and the charge for water for warehouses, shops, and offices, &c., not connected with dwelling-houses will be increased 10 per cent. It was said the revision of the charges would bring in an increased revenue of about £7000.

Suicide by Gas.—Two more cases of suicide by gas poisoning have occurred in Manchester. John Edward Clive Wright, a draper, of West Gorton, was found dead in bed by his brother. From the gas-jet there was a tube extending to the bed and placed under the clothes near deceased's mouth. The gas was turned on full, and Wright had been dead for at least an hour when found. At the inquest, when a verdict of "*Felo de se*" was returned, the evidence showed that deceased had been in ill-health for some time, and had had other troubles. The second case was that of a charwoman named Mary Myers, who lived in Chorlton-on-Medlock. She had been missing for some days, and on her bedroom door being forced open it was found that the gas had been turned on, and that the woman was dead in bed. She had locked the door, stopped up all the apertures with articles of clothing, fastened down the windows, and tied a stocking over her mouth. "Suicide" was the Jury's verdict.

Quality of the Gas at Slough.—It having been reported to the Slough Lighting and General Purposes Committee that the quality of the gas supplied to the public lamps was not so good as it should be, they recommended that the attention of the Gas Company be called to the fact, with a request that some improvement be made; and this course the Urban District Council have agreed to. One member said that the lack of light in the main streets was due to naphthalene.

Salford Corporation Bill Dropped.—Messrs. Dyson and Co., the Parliamentary Agents to the Salford Corporation, have been instructed not to deposit the Salford Corporation Bill for 1910, of which notice had been given (*ante*, p. 623). It is hoped that arrangements may be made with the authorities in the gas supply area that will enable the Corporation to promote a General Bill at the earliest possible moment. The authorities affected have received a communication from the Town Clerk of Salford suggesting a conference with the object of arriving at a settlement of the differences which led to such strenuous opposition on the part of the former to the gas clauses in the last Bill.

At the close of the evening service at Chapel Street Congregational Church, Southport, last Sunday week, the electric wires fused; and the building was plunged in darkness. The lighting of a few gas-jets, which were fortunately in position, enabled the congregation, however, to disperse with some degree of comfort.

Having had the matter of lighting the workhouse before them for about two years, the South Dublin Board of Guardians have adopted a report of the Special Lighting Committee which recommended "that the Local Government Board be requested to hold an inquiry into the relative merits of lighting by gas and electricity, as the Guardians intend to apply for a loan for electricity."

The fourth annual dinner in connection with the cricket club of the Isle of Thanet Gas Company was held at the Imperial Hotel, Margate, on the 11th inst.—the President (Mr. T. C. Fuller) occupying the chair. After the usual loyal toasts, that of "The Club" was proposed by Mr. Sandwell and responded to by the President and Mr. A. J. Stickels. Advantage was taken of the occasion to welcome the new Engineer, Mr. J. M. Campbell; and he thanked the company present for the way in which they had received him, and expressed his great appreciation of the hearty co-operation and sympathy of the officials and staff in taking up his new duties.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situation Wanted.

SECRETARY, MANAGER, AND ACCOUNTANT. No. 5115.

Stocks and Shares.

GAS COMPANY AVERAGING 9% PER CENT. No. 5165.

Financial Assistance Wanted.

INVENTION RELATING TO THE GAS INDUSTRY. No. 5164.

TENDERS FOR

Autogen Welding Shop, &c.

"K. W." 9873 c/o RUDOLF MOSSE, COLOGNE.

Fire-Clay Goods.

GUILDFORD GAS COMPANY. Tenders by Jan. 1.
MANCHESTER GAS DEPARTMENT. Tenders by Jan. 7.
ROTHERHAM GAS DEPARTMENT. Tenders by Dec. 31.

Regenerator Retort Settings.

GUILDFORD GAS COMPANY. Tender by Jan. 1.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 801.

Issue	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 14	10	Alliance & Dublin 10 p.c.	17—17⅛	—⅛	5 14 3
298,955	10	,,	7	Do. 7 p.c.	11⅝—12¼	—⅛	5 14 3
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	100—102	..	3 18 5
200,000	5	Oct. 28	6½	Bombay, Ltd.	5⅜—6	..	5 8 4
40,000	5	,,	6½	Do. New, £4 paid	4⅝—4⅞	+1/16	5 6 8
50,000	10	Aug. 26	15	Bourne-mouth Gas and Water Consolidated: 10 p.c.	28—28½	..	5 5 3
311,810	10	,,	7	Do. B 7 p.c.	16¼—16⅝	..	4 3 7
75,000	10	,,	6	Do. Pref. 6 p.c.	15⅛—15⅜	..	3 16 2
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	253—256	..	4 17 8
300,000	,,	,,	9½	Do. New	189—191	—1	4 19 6
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
206,250	,,	June 11	4	Do. 4 p.c. Deb.	100—102	..	3 18 5
220,000	Stk.	Sep. 10	11	Brighton & Hove Orig.	208—213	..	5 3 3
246,320	,,	,,	8	Do. A Ord. Stk.	150—152	..	5 5 3
460,000	20	Oct. 14	10	British	42½—43⅛	..	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c.	118—120	..	5 0 0
165,700	,,	,,	4½	Do. B 3½ p.c.	88—90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	106—108	..	5 1 10
55,000	,,	June 25	3½	Do. 3½ p.c. Deb.	88—90	..	3 17 9
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	14—14½	+⅛	4 16 7
250,000	Stk.	June 25	4	Do. 4 p.c. Deb.	99—101	+3	3 19 3
100,000	10	—	—	Cape Town & Dis., Ltd.	3—4	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅞—6⅜	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	47½—48½	..	6 3 9
100,000	Stk.	June 25	4½	Do. 4½ p.c. Deb. Stk.	82—84	..	5 7 2
157 150	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	108½—110½	..	4 10 6
1,493,280	Stk.	Aug. 26	5⅝	Commercial 4 p.c. Stk.	109—111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do.	103—105	..	4 15 3
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800 000	Stk.	Dec. 10	5	Continental Union, Ltd.	95—97*	..	5 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—139*	..	5 0 9
492,470	Stk.	—	5	Derby Con. Stk.	121—123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
143,995	,,	Oct. 2	5	East Hull 5 p.c. Ord.	97—99	..	5 1 0
486,090	10	July 14	12	European, Ltd.	24½—25	..	4 16 0
354,060	10	,,	12	Do. £7 10s. paid.	18—19	..	4 14 9
15,141,545	Stk.	Aug. 12	4⅜	Gas 4 p.c. Ord.	102½—103½	..	4 10 1
2,000,000	,,	,,	3⅜	light 3½ p.c. max.	87—89	..	3 18 8
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	103—105	..	3 16 2
4,193,975	,,	June 11	3	Coke 3 p.c. Con. Deb.	82—84	..	3 11 5
258,740	Stk.	Sep. 10	5	Hastings & St. L. 3½ p.c.	92—94	..	5 6 4
82,500	,,	,,	6⅔	Do. do. 5 p.c.	117—119	..	5 9 3
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17⅛—18	..	6 2 3
131,000	Stk.	Sep. 10	6½	Ilford A and C	144—146	..	4 9 0
65,783	,,	,,	5	Do. B	108—110	..	4 10 11
65,500	,,	June 25	4	Do. 4 p.c. Deb.	102—104	..	3 16 11
4,940,000	Stk.	Nov. 11	8	Imperial Continental	175—177	..	4 10 5
1,235,000	Stk.	Aug. 12	3⅜	Do. 3½ p.c. Deb. Red.	94—56	..	3 12 11

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Aug. 26	6	Lea Bridge Ord. 5 p.c.	119—121	..	4 19 2
561,000	Stk.	,,	10	Liverpool United A	223—225	..	4 8 11
718,100	,,	,,	7	Do. B	166—168	..	4 3 4
306 083	,,	June 25	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	Nov. 26	6	Malta & Mediterranean.	4⅜—5	..	6 0 0
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	59—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd.	12⅜—13	..	5 7 8
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con	106—108	..	4 3 4
518,795	Stk.	June 25	3½	Do. 3½ p.c. Deb.	93—94	..	3 14 6
55,940	10	Aug. 26	7	North Middlesex 7 p.c.	13—13½	..	5 3 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	137—139	..	5 15 1
60,000	5	Sep. 10	8	Ottoman, Ltd.	6⅛—6⅜	..	6 5 6
31,800	53	Aug. 26	13	Portsea Island A.	137—139	..	4 19 0
60,000	50	,,	13	Do. B.	129—131	..	4 19 3
100,000	50	,,	12	Do. C.	120—123	..	4 17 7
114,800	50	,,	10	Do. D and E.	101—103	..	4 17 1
398,490	5	Oct. 28	7	Primitiva Ord.	7—7⅛	+⅛	4 16 7
796,980	5	July 29	5	Do. 5 p.c Pref.	5⅛—5⅜	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	97—99	+5	4 0 10
1, 00,000	10	Oct 14	8	River Plate Ord.	16⅞—17⅛	+¼	4 12 9
312,650	Stk.	June 25	4	Do. 4 p.c. Deb.	100—102*	+3	3 18 5
250,000	10	Sep. 29	8	San Paulo, Ltd.	14⅜—15	..	5 6 8
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅞—12¼	..	4 18 0
125,000	50	July 1	5	Do. 5 p.c. Deb.	51—52	..	4 16 2
135,000	Stk.	Sep. 10	10	Sheffield A	233—235	+3	4 5 1
269,984	,,	,,	10	Do. B	233—235	+3	4 5 1
523,500	,,	,,	10	Do. C	233—235	+3	4 5 1
70,000	10	Oct. 14	10	South African	12¼—12⅝	..	7 16 11
6,429,895	Stk.	Aug. 12	5¼	South Met., 4 p.c. Ord.	119—121	..	4 8 1
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	82—84	+1	3 11 5
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	160—162	..	4 18 9
605,000	Stk.	Aug. 12	5½	S'th Suburb'n Ord. 5 p.c.	119—121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122—124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	109—111	..	4 10 1
120,000	Stk.	Aug. 12	6⅞	Tottenham A 5 p.c.	133—135	..	5 1 9
453,940	,,	,,	5⅝	and B 3½ p.c.	111—113	..	4 15 3
149,470	,,	June 25	4	Edmonton 4 p.c. Deb.	100—102	..	3 18 5
182,380	10	June 11	8	Tuscan, Ltd.	9—9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	10 —102	..	4 18 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.	110—112	..	4 9 3
255,636	Stk.	Aug. 26	6⅝	Wands- B 3½ p.c.	139—141	..	4 14 0
79,416	,,	June 25	3 worth 3	worth 3 p.c. Deb. Stk.	73—75	..	4 0 0
895,872	,,	Aug. 12	5⅜	West Ham 5 p.c. Ord.	123—125	..	4 6 0
210,000	,,	,,	5	Do. 5 p.c. Pref.	127—129	..	3 17 6
253,300	,,	June 25	4	Do. 4 p.c. Deb Stk.	108—110	..	3 12 9

Prices marked * are "Ex div."

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CHRISTMAS HOLIDAY.

In consequence of the CHRISTMAS HOLIDAYS, it will be a convenience if Communications for the next issue of the "JOURNAL" and Orders respecting ADVERTISEMENTS are received at the Office by 10 o'clock ON FRIDAY MORNING.

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THE Gas Committee invite Tenders for the Supply and Delivery of the FIRE-CLAY GOODS required during Next Season at their several Gas-Works.
Full Particulars and Forms of Tender may be obtained from Mr. Fredk. A. Price, Superintendent, at the Gas Offices, Town Hall, Manchester, on payment of a deposit of Two Guineas, which will be returned on receipt of *bonâ-fide* Tender.
Sealed Tenders, endorsed "Tender for Fire-Clay Goods," addressed to the Chairman of the Gas Committee, must be delivered at the Gas Offices, Town Hall, Manchester, on or before Friday, the 7th of January, 1910.
The Gas Committee do not bind themselves to accept any Tender, and reserve to themselves the right to divide any Offer as they may deem advisable.
By order,
WM. HENRY TALBOT,
Town Clerk.
Town Hall, Manchester,
Dec. 17, 1909.

COUNTY BOROUGH OF ROTHERHAM.
THE Gas-Works Committee of the Rotherham Corporation are prepared to receive TENDERS for the Supply of RETORTS and FIRE-CLAY GOODS.
Specifications, Quantities, and Forms of Tender may be obtained upon Application to the undersigned.
The Person whose Tender is accepted will be required to enter into a Contract which will contain the usual Fair-Wages Clause.
Tenders, endorsed "Retorts and Fire-Clay Goods," to be sent to the Town Clerk not later than Friday, the 31st of December next.
By order,
J. S. NAYLOR,
Engineer and General Manager.
Gas-Works, Rotherham,
Dec. 20, 1909.

GUILDFORD GASLIGHT AND COKE COMPANY.
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Specifications and further Particulars can be obtained upon Application to Mr. P. C. Cleasby, Gas-Works, Guildford.
Tenders, Sealed and Endorsed "Tender for Retorts" or "Tender for Settings," addressed to the Chairman of this Company, to be delivered at these Offices not later than 9.30 a.m. on Saturday, the 1st of January, 1910.
The Directors do not bind themselves to accept the lowest or any Tender.
By order,
WILLIAM TITLEY,
Secretary.
Gas Offices, Onslow Street,
Guildford, Dec. 14, 1909.

WEST HAM GAS COMPANY.
NOTICE is Hereby Given, that in pursuance of the provisions of The Gaslight and Coke Company's Act, 1909, under which this Company will become amalgamated with The Gaslight and Coke Company on the 1st of January next, the REGISTERS OF TRANSFERS OF CONSOLIDATED ORDINARY, PREFERENCE, and DEBENTURE STOCKS of this Company WILL BE PERMANENTLY CLOSED on and after the said 1st of January next, upon which date Stocks of The Gaslight and Coke Company will be issued in substitution for the corresponding Stocks of this Company, and on and after which date Transfers must be prepared in Terms of the substituted Stocks.
Transfers of Consolidated Ordinary, Preference, and Debenture Stocks of the West Ham Gas Company will therefore not be received for Registration in this Company's Books after the 31st of December, 1909.
By order,
A. G. SNELGROVE,
Secretary
Stratford, E., Dec. 18, 1909.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.
MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
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MAIN LAYING.
Paper by PERCY GRIFFITH, M.Inst C.E., and BRUCE McGREGOR GRAY, Assoc.M Inst.C.E., before the Association of Water Engineers.

A. The Authors used *Flanged Pipes* for the Rising Main up the Steep side of the Barff, and their experience proved that this was not an advantage, as *the rigidity of the Joints involved considerable difficulty* in regard to the depth of the Trench, and a good deal of Cutting to make the final Connections at each end of the Pipe-Line.

B. In the case of the Delivery Main, the Joints were *Ordinary Socket Joints*, but made with Lead only. The only difficulty met with here was the necessity for *pouring the Lead in* at a suitable temperature *to prevent it melting the Solid Lead Fillet*, and *running through into the Pipe.*

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CAST-IRON PIPES FOR GAS, WATER, & STEAM,
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CARBONIZATION MADE EASY.
A Few Recommendations for this System:—

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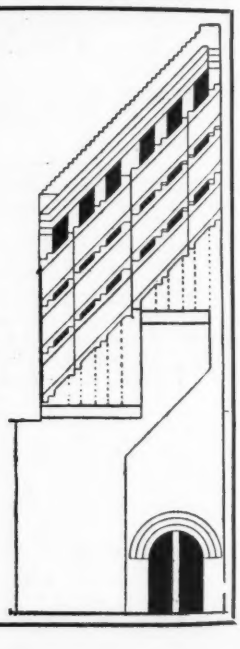
No **Machinery** to get out of order.
Carbonizing charges **40 per cent. less** than with Horizontals.
No skilled Stokers necessary.
Yield of Gas per ton guaranteed about 1000 cubic feet more than under present conditions, of guaranteed candle power.
Heats under absolute control throughout the whole length of the Retorts.
Saleable value of Coke greatly increased.
25 per cent. greater yield of Ammonia.
More liquid Tar.
Stopped Pipes unknown.
Naphthalene always in solution.
45 per cent. less ground space required.
Constructional cost per Ton carbonized considerably less than with Horizontal or Ordinary Inclined Retorts.
Several Installations in course of construction or completed.



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Important Improvements.

BURNERS.

1. **20-Candle Power more light** without increase in the consumption of gas.
2. **Patent Gas Adjuster;** cannot get out of order.
3. **Automatic Gas Regulator,** ensures a constant and unvarying pressure of 35 mm., guarantees a steady light, at the same time obviating waste of gas and blackening of the burner.
4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
6. The brass casing is heatproof, and, if occasionally cleaned with warm water, will not become discoloured.

LAMPS.

From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

Prepare for Frost.

THE MOST UP-TO-DATE

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AS FITTED TO THE LARGE SPIRAL HOLDER,

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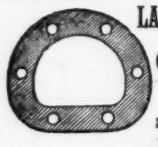

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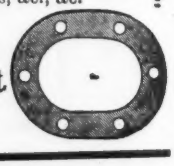

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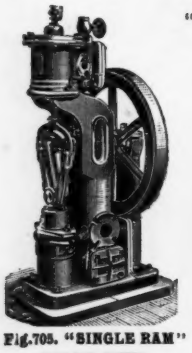

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

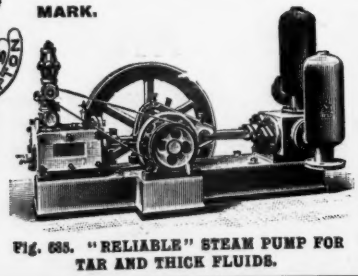

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

Rheinische Chamotte-und Dinas-Werke, Cologne on Rhine.
Construction of
Entire Gas-Works & Coke Oven Plants,
Retort Furnaces,
Furnaces for Chamber Settings (*Patent*), New Coke Ovens (*Patent*),
With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.

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HORIZONTAL, VERTICAL, INCLINED

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SO FAR 97 CHAMBERS BUILT AND BUILDING FOR A DAILY PRODUCTION OF

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THE

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INVERTED BURNERS.

No. 3 "DARWIN." 3½in. Fitting.

Have been remodelled, and we now offer you

BETTER BURNERS

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REDUCED PRICES

And guarantee the highest finish and Workmanship.

Independent Test by a well-known Gas Manager of No. 3 Burner.

CONSUMPTION . . . 3·55 ft.
of Gas at 15/10ths Pressure,

CANDLE POWER . . . 122·76

These figures speak for themselves.

Breakage of Mantles and

MAINTENANCE CHARGES

Reduced to a minimum.

Made in 3 SIZES and 8 PATTERNS

BY

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PATENT HYDRAULIC MACHINERY

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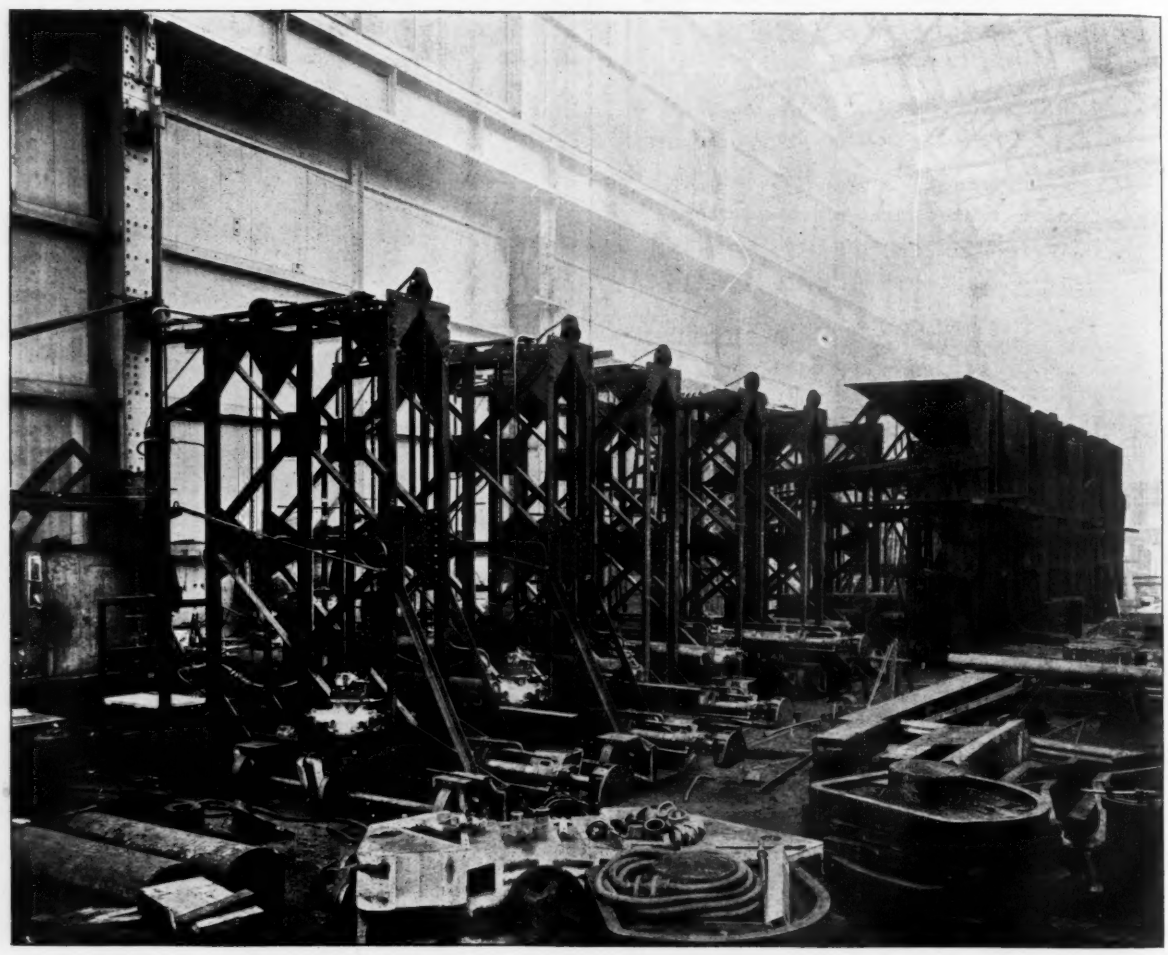

SIX 20 ft. THROUGH RETORT HUNTER-BARNETT PATENT COKE PUSHERS, and

SIX ARROL-FOULIS PATENT CHARGING MACHINES capable of charging up to Six cwt. per Mouthpiece.

PART ORDER OF TWENTY-TWO MACHINES

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FOR FULL PARTICULARS APPLY TO THIS ADDRESS.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

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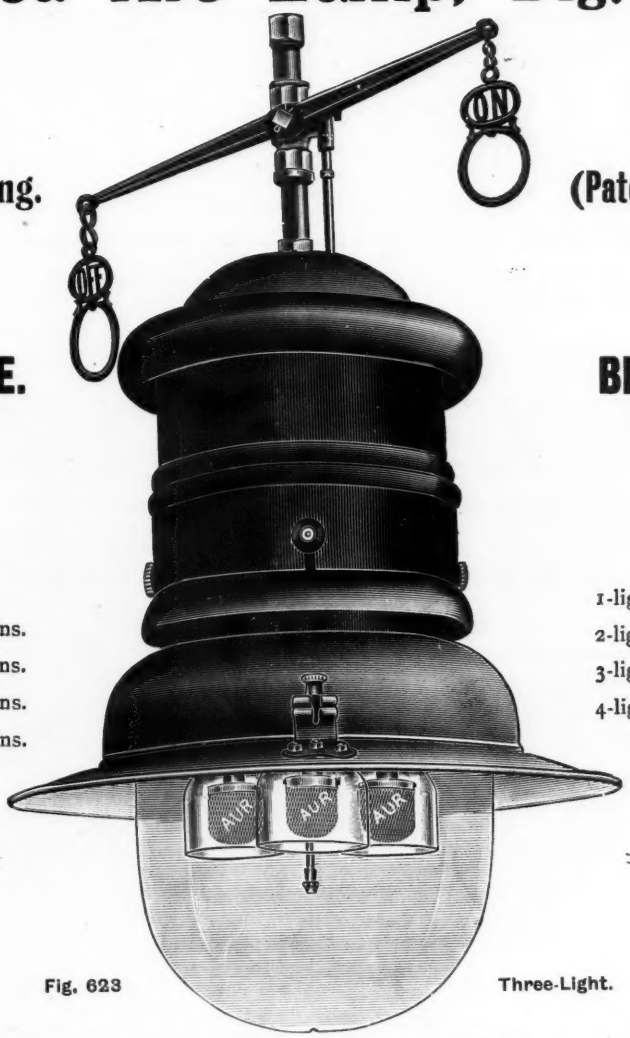

Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*		*1-Light.*	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**	Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**	Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made
Case contains . .	*80*	*18*	*18*	*12*	Welsbach Mantles, each **6d.** subject as usual.				

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

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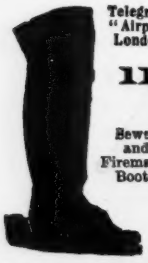
Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*



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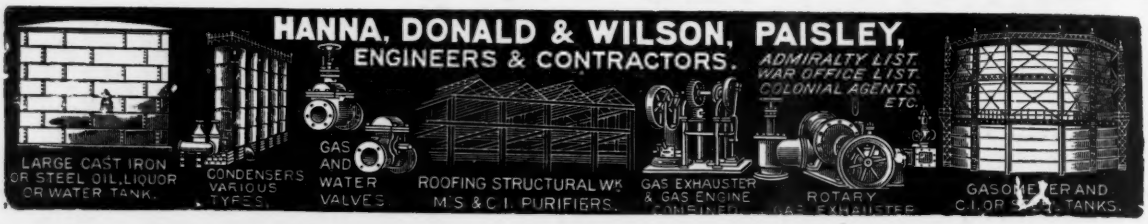

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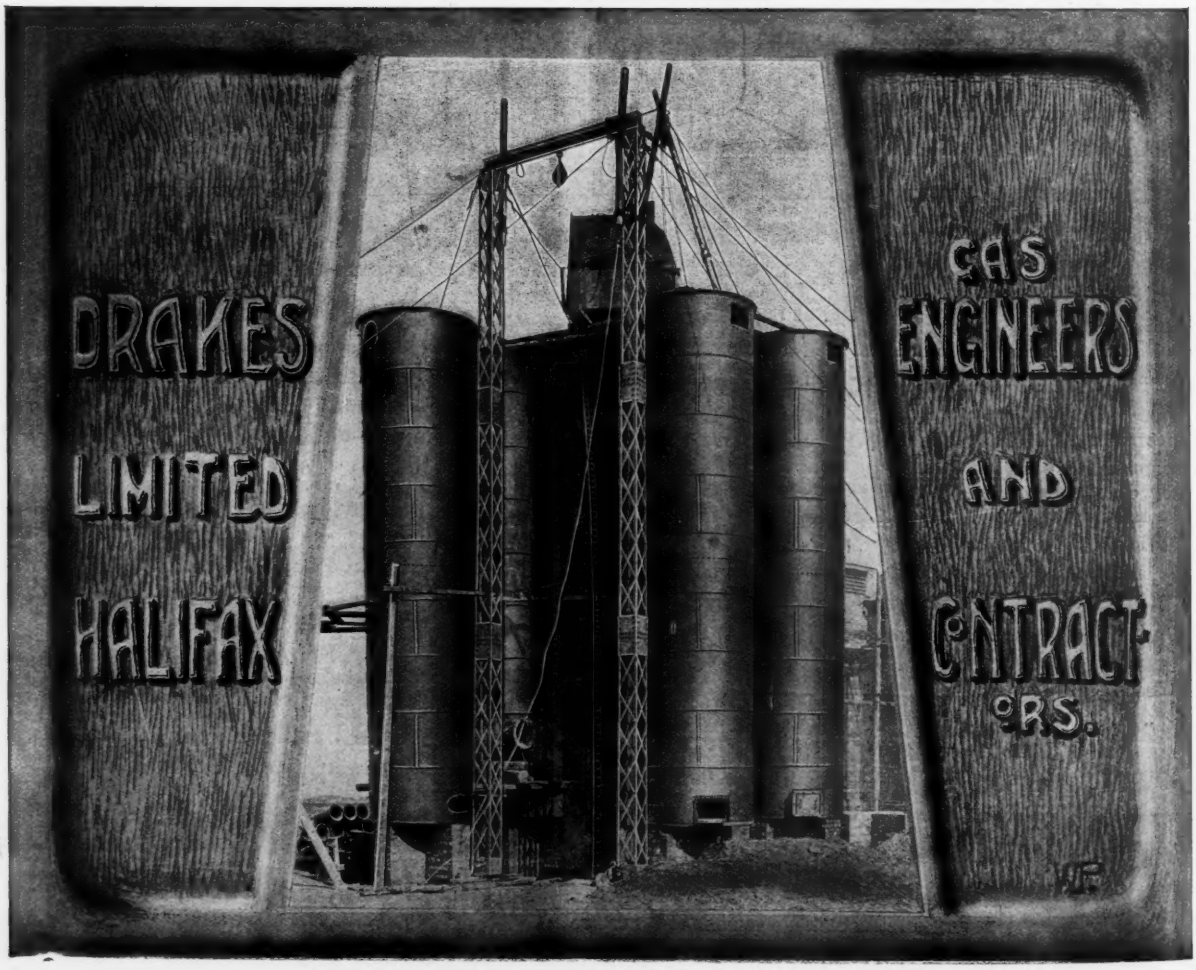

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MANUFACTURED FROM OUR CAREFULLY SELECTED AND WELL SEASONED STOCK OF OLD MINE FIRE CLAY.
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THE "DARWEN" ARCH PIPE

Prevents Stopped Ascension Pipes.

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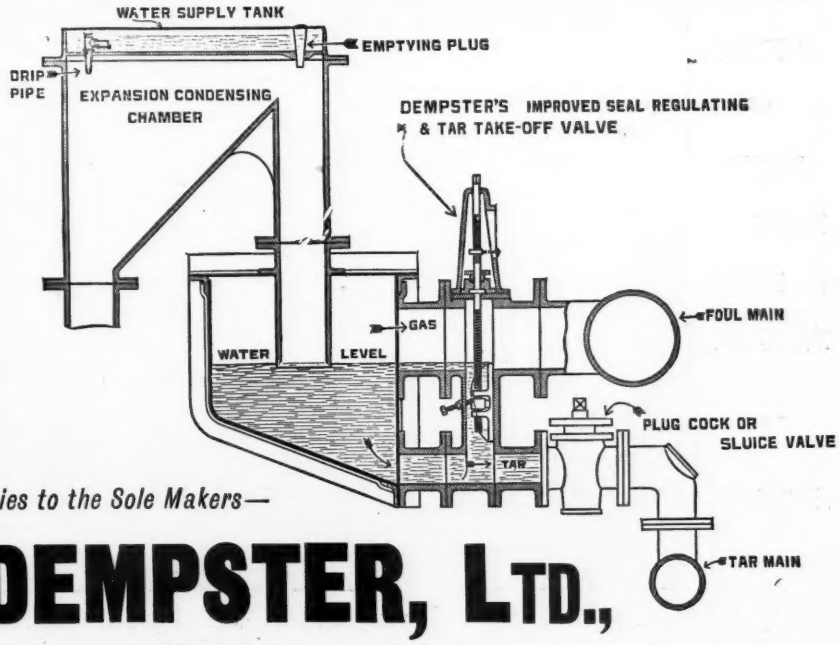
"The Arch Pipes can be seen in operation upon application."

"It will pay you to try them upon troublesome Pipes."

Upwards of 400 are already at Work or on Order.



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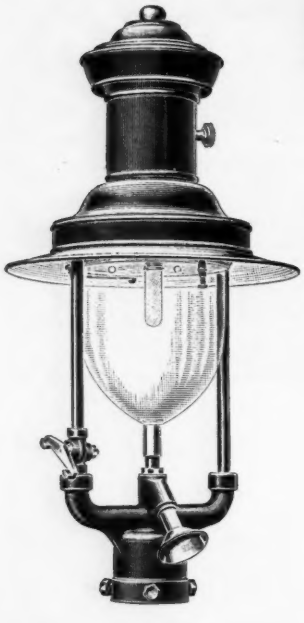

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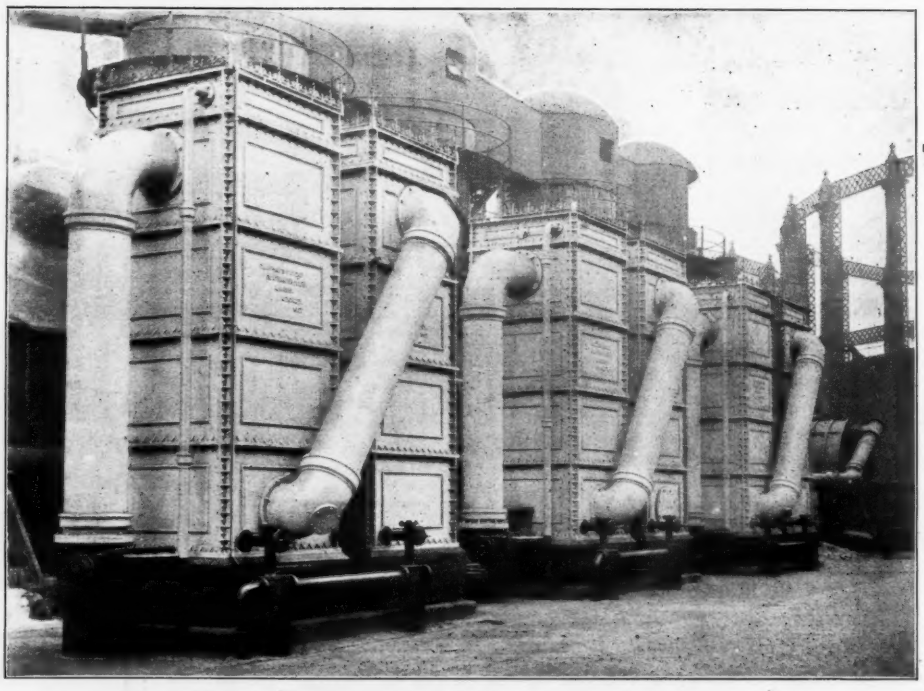

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